

JOURNAL
OF THE
ROYAL ASIATIC SOCIETY OF BENGAL

SCIENCE

Vol. VI, 1940, No. 2

(Concluding Number)



CALCUTTA

PRINTED AT THE BAPTIST MISSION PRESS

PUBLISHED BY THE ROYAL ASIATIC SOCIETY OF BENGAL, 1, PARK STREET

Issued June, 1941

Price Rs.4-8-0

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The Magic Cakras¹ and Rectilinear Orbits in Ancient Astronomy.

By C. P. S. MENON.

(Communicated by Prof. M. N. Saha.)

1. Ever since Aristotle laid it down as an indisputable truth that the circle, having neither beginning nor end was the most perfect figure and, as such, the most fitted by Providence to represent the eternal shapes of the Universe and, in particular, of the celestial orbits, we have been accustomed to astronomical theories attributing to the celestial orbits a circular shape or else a shape closely dependent on the circle², so much so that it looks strange if we were told that at one time there were schools of thought which attributed rectilinear motion to the celestial bodies. We do not even take due notice of the fact that Aristotle and others were refuting such doctrines while asserting the perfection of the circle and its consequent choice by the *Primum Mobile* as the appropriate form for moulding the celestial orbits. Either because these strange beliefs could not stand the searchlight of criticism, or because of their inherent appeal to latent *reality* as distinguished from *appearance*, or more probably due to both these causes, they no longer appear in the fold of the rational sciences, but they seem to have survived in the more favourable atmosphere of astrology and the occultistic and mystic codes. Hence it is but proper to ransack these codes to collect bits of evidence which are likely to throw some light on the old system of belief in rectilinear motion.

A good deal of evidence of the belief as well as of its connection with a square-shaped Universe, with magic *Cakras* and with art and architecture of the ancients has been set forth by the present writer elsewhere³. The purpose of the present paper is to shed more light on those beliefs and to indicate a closer connection between the magic *Cakras* and the rectilinear

¹ 'C' pronounced as 'ch' in 'chair'.

² Thus the later Greek theories of Eccentrics and Epicycles are still dependent on the circle; while Kepler's ellipse may be broadly regarded as a modification of the circle.

³ *Early Astronomy and Cosmology* (London, 1932—History of Science Library edited by Prof. A. Wolf.) The book also contains plenty of references to other features common to the Hindu, Chinese, Babylonians and other ancient civilizations, such as the *Nakshatras* and the *Sieon* and other divisions of the Zodiac, and their relation to the Square Scheme. See Index *s.v.* Borders, Creatures, Decans, Lunar Mansions, Zodiac (divisions of).

orbits; an attempt is also made to furnish a plausible explanation of these *Cakras* as also of their beliefs in rectilinear motion itself.

2. Before proceeding to deal with these entirely new pieces of information, it is desirable to gather here, in brief, a few of the more important points described in the above book in support of the theory, and a few similar points.

Several of the old Ionian and some Greek philosophers held that the *phenomena* were different from *reality* and they had theories of the latter by means of which they sought to explain the former¹. Xenophanes of Kolophon (born about 570 B.C.) seems to have taught that the motion of the celestial bodies is rectilinear, the apparent circular forms of their daily orbits being only an illusion caused by their great distance from the observer².

Similar references to real orbits as distinct from apparent ones are met with in the *Sūryaprajñapti*, a Jaina astronomical treatise, and in a Chinese work called the *Tcheou-pei*³. These

¹ To quote a few instances:—Anaximander of Miletus (Circa 6th cent. B.C.) held that the sun, moon and stars were each a wheel of fire with a number of holes in the rim, through one or other of which the fire was visible at a given time, the other holes being closed; the eclipses occurring when the vents were all shut up. He arrived at this conclusion by starting from the premise that the first principle (material cause) was the Infinite and arguing that from this was separated 'that which is capable of begetting the hot and the cold', from which arose, in virtue of eternal motion, 'a sort of sphere of flame', and whence in turn were torn off the rings of fire mentioned above. Other philosophers followed in the same way arguing from the premise of a primordial substance and arriving at various conclusions about the shapes of the heavens and the heavenly bodies and their appearances and disappearances (*cf.* Doxography). Parmenides of Elea (early part of 5th cent. B.C.) maintained that the apparent rotation of the heavens is an illusion, since there is no such thing as *void*, and change and motion cannot be conceived without an empty space; and further that attainment of truth about the phenomenal world was impossible because of the imperfection of our senses (*op. cit.*). Again, regarding the Pythagorean belief in the motion of the earth and a 'counter-earth' round a central fire, Aristotle remarks '....in this they are not seeking explanations and causes to fit the observed phenomena, but they are rather straining the phenomena in the effort to make them agree with certain explanations and views of their own. Many others might agree with them that the place in the centre should not be assigned to the earth, if they looked for confirmation, not to the observed facts, but to *a priori* arguments' (*De Caelo*, B 13, 293, A 15-b 30);—*e.g.* (1) Fire is worthier than earth to occupy the worthiest place, the centre of the heavenly sphere (*loc. cit.*) and (2) 'regarding as they do the number ten as perfect and as embracing the whole nature of numbers, they say that the bodies moving in the heavens are also ten in number, and, as those which we see are only nine, they make the counter-earth the tenth' (*Metaphysics* A 5, 986a 1).

² *Cf.* Aetius II, 24. He also held that 'there are many suns and moons according to the regions, divisions and zones of the earth'—*cf.* the double set of constellations, sun and moon mentioned in the *Sūrya prajñapti* and the *Tcheou-pei* (see below).

³ *Cf.* Thibaut's article on the *Sūryaprajñapti*—J.A.S.B. Vol. 49, p. 203 *seq.*; Menon: *Op. cit.*, pp. 28, 91 *seq.*, 162, 167; also *infra*, footnote 2, p. 53,

explain the rising and setting of the stars by their becoming visible at certain distances from us¹. Also, the change of altitude of the mid-day sun throughout the year is explained by giving them a series of daily orbits on a horizontal plane above which become wider from summer solstice to winter solstice and shorter on the backward journey from winter solstice to summer solstice. Though the commentator of the *Sūryaprajñapti* proceeds to give the diameters and circumferences of these orbits, in a later chapter the text assigns a square orbit to the sun; the moon's orbit is yet held to be circular. There is little doubt that this work, and certainly the commentary on it, is a later exposition² of a very early cosmology founded on the square scheme many of whose features are mixed up with later ideas corresponding to a circular or spherical cosmology; this is presumably the reason for assigning the square shape to the orbit of one body and the circular shape to another. The Buddhistic times especially seem to be involved in the transition from the square to the circle. For, a similar transition is found in the shape of Mount *Meru*, the centre

¹ Anaximenes of Miletus held that 'the sun is hidden from sight, not because it goes under the earth, but because it is concealed by the higher parts of the earth, and because the distance from us becomes greater' (Hippolytus Refut. I. 7).

² The *Sūrya-prajñapti*, judged by the general astronomical features of its contents such as the five-year cycle, belongs to the post-vedic and pre-Siddhāntic period of Hindu Astronomy to which also belong the *Jyotiṣha-Vedāṅga*, the *Mahābhārata*, some of the *Purāṇas*, the fragments of *Vṛiddha-Garga*, etc.; this period according to P. C. Sen Gupta is 1400 B.C.—2 A.D. (cf. The Cultural Heritage of India—Ramakrishna Centenary Memorial, Vol. III, p. 347); or to be more conservative, I put it between the 12th cent. B.C. and the 1st cent. A.D.—the upper date being determined by the position of the solstitial colure mentioned in the *Jyotiṣha-Vedāṅga* and other texts (allowing for possible errors), and the lower date by the mention of 2 Śāka (80 A.D.) in the *Paitāmaha Siddhānta* of Varāhamihira's *Pancha-siddhāntika*. Some features like the double set of constellations and quadrangular *Meru* (*vide infra*) are

attributed to *Jina* himself: 'भानि चतुःपञ्चाशत् द्वावर्कोदयौ जिनोक्तं यत्' (Bhāskara: *Siddhānta-Siromani*). According to Jaina tradition represented by a current era, Mahāvīra was born about 599 B.C. (cf. Cultural Heritage of India, Vol. I, p. 220); and Gautama Buddha, the junior contemporary, passed away about 485 B.C. Hence I consider that most of the characteristics of the text must have been formed and gathered together by about 500 B.C. It is quite possible, and even probable, that the Māgadhi text itself was composed or systematized in the present form as one of the Jaina secondary canons only in the 1st cent. A.D.; the Sanskrit commentary by Malayagiri is much later indeed. The astronomical features of the text are certainly very remote from those of the later and more scientific Siddhāntas of the period beginning with Āryabhaṭṭa (499 A.D.).

Tcheou-peï is one of the oldest Chinese mathematical texts, written at least as early as 1100 B.C., though some of the portions dealing with cosmology are regarded as later (2nd cent. B.C.); in the latter case, the scheme may have been imported by Buddhist missionaries from India (Menon: *op. cit.*, p. 92; Thibaut—J.A.S.B. Vol. 49).

of celestial motion in the above system: while its cross-section was regarded as 'quadrangular, not round' in 'the book of *Jina* i.e. of the Buddha,'¹ the Buddhists are reputed to have believed that Meru 'is square at the base, round at the top'.² The same transition from the square to the circle must have been the reason for the confusion in the minds of the priests of the *Brāhmaṇa* period, whether altars to be constructed for certain ceremonies should be in the shape of a square or a circle.³

The dimensions of the daily orbits of the sun and the height of the plane on which they lie, as seen from the 'extremity of the earth' (*Jambudvīpa*), which are detailed in the *Sūrya-prajñapti* appeared to be no more than absurd fancies of theologists. Indeed, they led to absurd results, when the orbits were taken as circular. For instance, since the distance between the two solstitial orbits must subtend at the observer an angle equal to twice the obliquity of the ecliptic ($= 2\omega$), the position of the observer is given by the intersection of a segment of a circle standing on a chord $= 510$ *yojanas* and containing an angle 2ω with a line drawn parallel to the chord at a distance of 800 *yojanas*. But actual drawing shows that the line does not meet the circle at all—tending to show that the figures were fictitious. On the other hand, assuming the orbits to be squares and the solstices to be represented by the corners⁴, one could show that the given dimensions not only yield a possible value of the latitude ($= 6^{\circ}18'$), but also an appreciably correct value of the obliquity. $6^{\circ}18'$ is obviously an appropriate value for the latitude of the end of *Jambudvīpa*, the southernmost point of Ceylon (Dundra Head) being now at a lat. of $5^{\circ}56'N$. This treatment gave sense also to another set of measurements described as observed from 'us'; the latitude of this 'our' place was obtained as $29^{\circ}39'$, which roughly corresponds to *Hastinapura* of *Mahābhārata* fame, where flourished a great civilization and great astronomers like *Vṛiddha-Garga* and *Parāśara*. Astronomers from this place evidently observed the changes of altitude of the sun here, and also proceeded to Ceylon to make further measurements, so as to deduce the dimensions of the orbits. Having calculated the distance between the solstitial orbits assumed to lie on a horizontal plane 800 *yojanas* above the end of *Jambudvīpa*, and then with the idea that the solstices correspond to the corners of the squares, reducing the distance to a difference between the *sides* of the orbits and of *Jambudvīpa* (also conceived as a square),

¹ Cf. Al Biruni's *India*, page 243; several *purāṇas* also make Meru square. Cf. Menon, *op. cit.*, p. 87 *et seq.*

² Cf. Al Biruni, *op. cit.*

³ Menon, *op. cit.*, p. 74; there are several passages in the *Brāhmaṇas* to this effect.

⁴ These assumptions are warranted by a large mass of evidence; cf. Menon, *op. cit.* Index *s. v.* Corners (sanctity of).

and further assuming a round number 100,000 yojanas for the side of *Jambudvīpa*, they seem to have arrived at the numbers given in the text. Thus what appeared to be absurd on the hypothesis of circular orbits is at once seen to be perfectly sensible and to yield remarkably accurate and appropriate results on the hypothesis of square orbits.

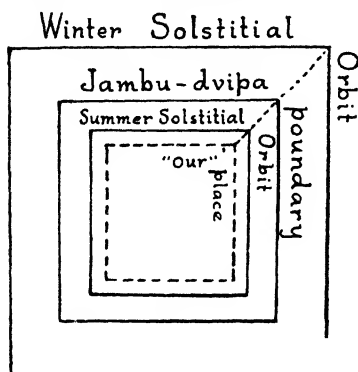


Fig. 1

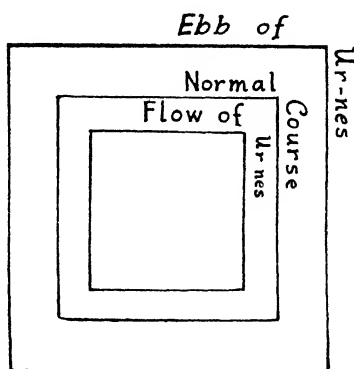




Fig. 2

(Ab = 180 yoj. bc = 330 yoj.
Ad = 40. Ac = $510\sqrt{2}$ yoj.)

3. A similar set of orbits (see Fig. 2) seems to be implied in the descriptions of certain cosmological conceptions of ancient Egypt. The Universe was a sort of rectangular box supported by four pillars at the cardinal points, which were connected by a chain of mountains. On a ledge somewhat below the top of these the celestial river *Ur-nes* flowed round the earth, carrying the bark of the Sun. During the course of the year, the *Ur-nes* ebbs and flows, the Sun's boat always keeping to the bank nearest to man; at summer solstice the river (like the Nile) overflows, so that the Sun's orbit is nearest to man and his altitude highest; whilst at winter-solstice the river ebbs causing the boat's path to be farthest from man and making the Sun's altitude least. There are also references to the *Ur-nes* turning *sharply* round at the southern point. The similarity of Fig. 2 to Fig. 1 is evident.

4. Apart from these daily orbits, the annual motion was represented by means of divisions of a square enclosure, and it is very probable that the zodiac itself was conceived as a square rather than a circular enclosure. In India one is familiar with the *Rāśi Cakra*, the square with its twelve small squares round the edges, which is used by the astrologer to represent the positions of the celestial bodies at any given time. The solstices and equinoxes were intimately connected with the corners of the square, as though the zodiac was actually conceived as a

square. There were other enclosures, like the horizon, which were also conceived as square (*caturanthā*)¹. The Babylonian symbol for 'enclosure' is traceable to the primitive *Hal* symbol , which is just a square²; the ecliptic was called *kes-da*, 'the enclosure'³. Several of these rectangular enclosures are found on Babylonian boundary stones, cylinders and seals in conjunction with animals of the early zodiac or other objects of definitely astronomical import.⁴ The Chinese symbol for

the earth was , a quadripartition of the square⁵. The Babylonian *Hal* symbol was also applied to *Zikum*, heaven; and again to *Apsu*, the Great Deep, wherein was rooted the world-tree which spread its branches into *Zikum*. Thus the rectilinear orbit appears as part of a square-based earth and a square-based Universe; and much of ancient symbolism and culture was bound up with the square form.

5. '*Astrological conceptions.*' The following extracts from an article in the *Encyclopædia of Religion and Ethics*⁶ are worth quoting as further evidence confirming the theory of the ancient conceptions of rectilinear orbits and Universe and their symbolism and practical manifestations. After referring to the division of the zodiac and to the corresponding division of the observer's celestial equator 'into 12 apparently stationary parts', and showing how these parts called 'houses'⁷ are connected with the horizontal directions, the writer says:

'This method of parcelling out the sun's apparent daily course must have been instituted at a very remote period, in an age indeed when the astronomer had not yet grasped the idea of a circular orbit, but still thought of the solar path as a square.⁸ In the figure representing the horoscope⁹ this quadrangle form was retained, and it has remained in use till modern times, and in fact till the present day. To this method of delineating the stellar paths we shall frequently have to return, as a considerable number of symbols relating to God and the world were evolved therefrom.'

'The astrological conception of the world' is defended thus: '..... It is impossible to understand the theories of nature held by the ancients without a clear conception of the

¹ Cf. Monier Williams' *Sanskrit Dictionary*.

² *Babylonian and Oriental Record*, Vol. II, p. 258.

³ Brown: *Primitive Constellations*, Vol. II, ch. XI.

⁴ Menon, *op. cit.*, pp. 121-125.

⁵ Cf. D'Alviella, *Migration of Symbols*.

⁶ Vol. 12, pp. 54-56—article on 'Sun, Moon and Stars' by F. von Oefele.

⁷ Cf. Menon, *op. cit.* Index s. v. Houses.

⁸ Italics ours.

⁹ See Fig. 3. The original square houses must have given place to triangles later; cf. Menon, *op. cit.*, pp. 73, 140.

difference between their fundamental stand-point and our own. According to the older view of the world which can be traced

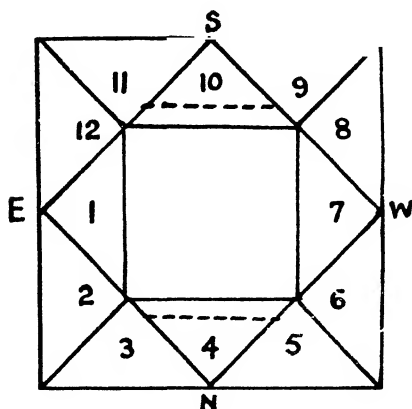


Fig. 3.

backwards for 5000 years before Christ, all natural objects issued in parallel lines from certain primary causes of universal operation. Modern Science, on the other hand, assumes that the various groups of physical phenomena proceed by differentiation from certain primordial forms

He again refers to 'the square form of the horoscope, as furnishing the ground-plan' of this theory of the world, and as showing the link which the theory had with astrology and also with two other occult sciences, Alchemy and the Kabbala. He points out 'that the symbols used in astrology for the four cardinal points were simply the triangles corresponding to the first, fourth, seventh and tenth houses respectively ¹. Δ came to mean north, ∇ south, \triangleright east and \triangleleft west.'

'The tenth house, as the *summum coelum*, and the fourth, as the *imum coelum*, embraced everything in the world above and the world below respectively. The upper world as a whole, however, consists of the eighth, ninth, tenth, eleventh and twelfth houses. In the hieroglyph script of Egypt, accordingly, heaven is represented by the exterior boundary of the five

houses, thus :  . . . The underworld was represented of

course by the same figure inverted According to one

¹ These symbols are just opposite to the plan given above; the incongruity is treated by the writer as due to the determination of the stars of the ecliptic by an observer in the north and the fixing of the cardinal points by his fellow in the south! But they agree with the orientation of the world described in our book.

conception, the *summum coelum* contains the heavenly upper ocean¹, from which rain falls, while the *imum coelum* contains both the ocean of the underworld and the sub-terrestrial waters from which the fountains of the deep² are fed. According to the other conception there lies above us first of all air, then fire; and beneath us, first earth, then water.'

The later theory furnished the alchemists' symbols of the elements: Δ Fire, \triangle Air, ∇ Earth and ∇ Water. These

symbols were used commonly by old physicians a hundred years ago; and sometimes in combination, e.g. \star denoted 'burnt water' or distilled alcoholic liquors. The last symbol 'was used not only in alchemy but also in the Kabbala, where it represented a star of David. It became, in fact, a symbol for God' (Heaven being regarded as a synthesis of Fire and Water).

According to the astrological conception of the world, 'not only the perpendicular section through the universe, but the surface of the earth itself was thought of as a quadrate, since the cube, as the ideal geometrical figure, was the accepted symbol of the world as a whole. This idea finds frequent expression even in later cabalistic writings treating of the origin of salt, which, of course, also crystallizes in cubes. The scheme of the horoscope accordingly became a comprehensive map of the world as well'.

6. *A mural picture of the Universe.* In a picture on a templewall³ depicting the *Brahmāṇḍa*, the cosmic-egg, the Sun is shown at the centre, the orbits of Mercury and Venus are shown as a pentagram (five-pointed star) and a (convex) pentagon respectively and Earth is in the ecliptic. Though this picture was painted at a comparatively recent date, there are several features in the scheme typical of the *Siddhāntas* and a few characteristic of the *Purāṇas* and the early rectilinear cosmology. It is presumably a mixture of several conceptions, ancient and later. The following is a translation of the relevant parts of the description accompanying the chart:

'At the centre of the Universe (Aṇḍa-kaṭāha) is the Sun. Nearest this Light of the World-theatre, the Sun, circumambulates Mercury five-corneredly; beyond this Venus also in a pentagon; and still beyond this the earth revolves like a ball.

¹ Cf. Biblical allusions in Menon, *op. cit.*, p. 23.

² Cf. Babylonian *Apsu*.

³ Wall of the *Śiva* Temple at Tripālur (a village 12 miles off Palghat in the West Coast of S. India). The picture is accompanied by an inscription in Malayalam, describing the details; it appears to have been finished on May 9, 1846, by one Vasudevar, disciple of Maha Yogishwara-swami, a sage 'who dwells in the Sahya mountains, in Amalakakshetra, on Brahmagiri hill, in a sacred cave'. I am indebted to Mr. P. R. Chidambara Iyer of the Kodaikanal Observatory for bringing the above account to my notice.

All planets turn round their naves and travel like waves, so that rising and setting are observed. The moon alone revolves round the earth. Mars revolves beyond; Jupiter turns beyond in his own orbit with one loop per sign (Rasi). Beyond Saturn revolves with three loops per sign. *Rahu* and *Ketu* are latent in this. Above Saturn is the orbit of the Great Bear (*saptarshi kakshi*); above this is the orbit of the 27 Nakshatras, above this is the orb of the Pole-star.'

Then follow measures of the diameters of the globes and orbits of the Sun and the planets with particulars of the 'Winds' that blow them along in their orbits; and then a description of the 18 'Worlds' composing the cosmic-egg, of which Earth answers for 9 worlds, the world of Heaven includes the above 11 orbits, and there are eights beyond, ending with *Vaikuntha* on the wall of this egg.

There are several peculiarities in this account. The postulation of several kinds of winds (Vāyu) as the agents causing the motion of the celestial bodies, the wave-like motion for the planets, and the mention of loops for Jupiter and Saturn are features of Hindu astronomy of the period of the Siddhāntas or earlier¹, rather than of the west. The rotation of the bodies including the earth and the place of the Sun at the centre are characteristic of western astronomy, though Aristarchos of Samos (3rd cent. B.C.) held the latter doctrine. But loops are not necessary in a heliocentric system; and though the earth is shown on the ecliptic, the writer gives the dimensions, not of the 'earth's orbit' but rather of the 'Sun's orbit'—which show that but for a superficial exchange of positions between the Sun and the Earth imposed later, the system is left intact in an early form. The division of the Universe into several worlds and the attribution of rectilinear orbits to two planets indeed indicate the very early origin of the system.

7. *The Orbit of Mercury.* It seems curious that the orbit of Mercury should have been supposed to be a five-pointed star; this figure was regarded by the Pythagoreans as endowed with mystical and occult qualities, and it was also employed in magic (cf. its name 'Wizard's Foot'). It is worth while trying to put oneself in the position of the early astronomer and explaining the phenomena with this orbit in view.

The main facts are:—(i) They would have observed that Mercury was never far off from the sun's direction, i.e. it oscillated round the line of sight to the Sun as a mean position, the maximum elongation (x) from the Sun being about 20° and the period being about 80 days.² (ii) They believed that Mercury

¹ 500 A.D. onwards. The 'motor' winds are described also in the Purāṇas (cf. *Matsya-purāṇa* 127, 12–17); these and the *vakra* and *anuvakra* motions were known to the Siddhāntas of the *Panchasiddhāntika*.

² I.e. approximately. The modern figures are: x varies between 18° and 28° and period = 88 days.

8. *The orbit of Venus.* If we attempted to explain the orbit of Venus in the same way, we find that one of the sides of the pentagon (say) a line of progression has to turn through an angle of 72° , when changing into the next side or line of retrogression, which means that the line of sight which is at right angles to the path must turn through $(180^\circ - 72^\circ)$ or 108° in the meantime. Therefore Venus was supposed to have a maximum elongation of 54° on either side of the line of sight to the Sun

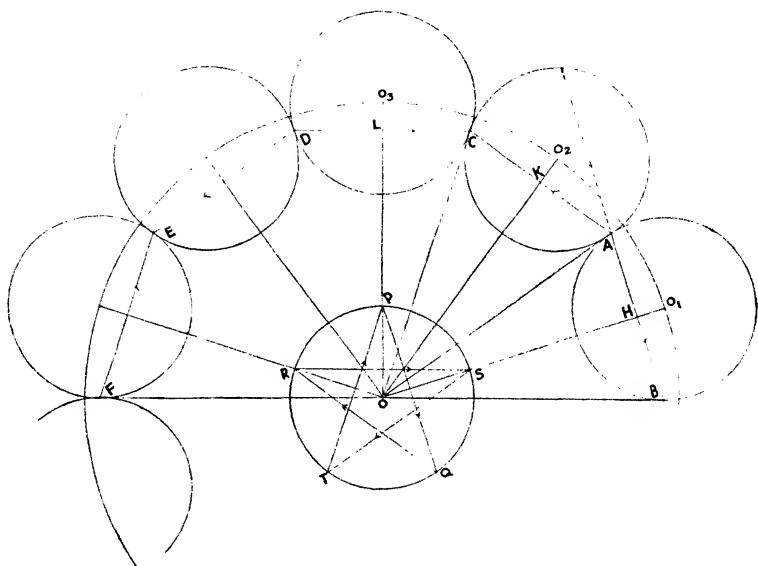


Fig. 5.

which turns through 108° in approximately 108 days, so that the period of Venus round the circle = 216 days.¹ This is near enough to the modern figure of 225 days. Neglecting any difference between these numbers and observed values as due to errors of observation², they might have argued as before and obtained the convex pentagon as the orbit of Venus.

9. *Other Cakras.* The above explanation of the orbits of Mercury and Venus lead us to attempt explanations of the other *Cakras* on the same lines.

¹ More accurately the period is $2 \times \frac{108}{360} \times 365\frac{1}{4}$ days = $219\frac{1}{2}$ days.

² There is nothing strange about this. Do we not do exactly the same thing when we neglect awkward decimals derived from observations and adopt simple numbers for our Laws, as for instance in the Inverse Square Law?

(i) The *Rāṣi Cakra*¹ or the wheel of signs is, as stated in section 4, connected with the divisions of a square and the solar zodiac. The Ecliptic or the 'Year-cycle' of the Aryans, the Babylonian Furrow-of-heaven, was pre-eminently the orbit

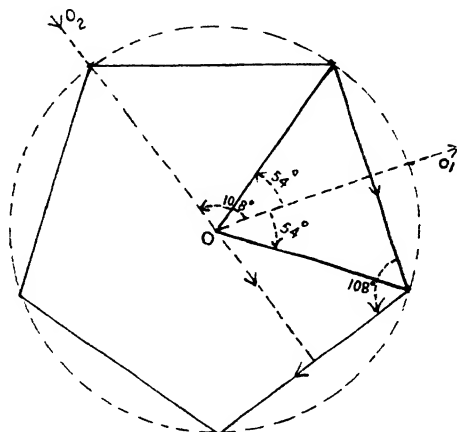


Fig. 6.

of the Sun. And it has been indicated above how this was represented by a square, and was probably regarded as a square. An explanation of the square orbit of the sun would be this:—

The Sun first travels along AB and then *turns* to BC; the line of sight turning through 90°. The motion of the Sun would then *appear* as an oscillation of 45° on either side of the

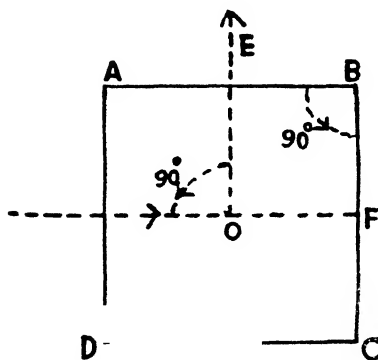


Fig. 7.

line of sight; this would be the case in places where the Sun rose N.E. at summer-solstice and S.E. at winter-solstice.

¹ Cf. Menou, *op. cit.*, p. 66 et seq., 156 seq.

altitude and azimuth (measured for convenience on either side of the South meridian). Let H_0 be the meridian altitude on that day.

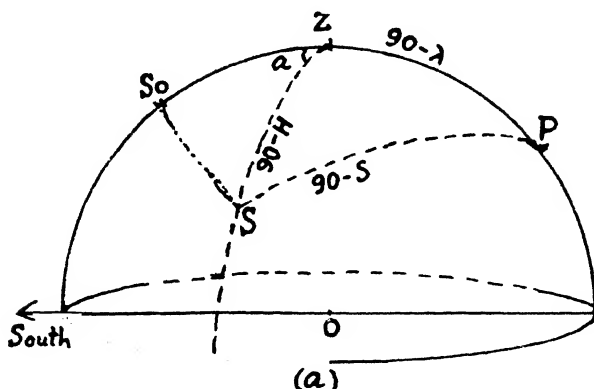


Fig. 10(a)

Then from spherical triangle ZSP.

$$\sin \delta = \sin H \sin \lambda - \cos H \cos \lambda \cos a \quad \dots (1)$$

When $H = H_0$,

$$\sin \delta = \sin H_0 \sin \lambda - \cos H_0 \cos \lambda \quad \dots (2)$$

Eliminating $\sin \delta$ between (1) and (2) we get an equation connecting H and $\cos a$ for the day.

On the equinoctial day, $\delta = 0$. Therefore (1) and (2) give

$$\cos a = \tan H \tan \lambda \quad \dots (3)$$

$$1 = \tan H_0 \tan \lambda \quad \dots (4)$$

$$\text{Therefore } \cot H \cos a = \tan \lambda = \cot H_0 \quad \dots (5)$$

Now, if p be the length of the style casting shadows,

$$\text{the shadow at Noon} = OA = p \cot H_0 \quad \dots (6)$$

and the shadow at $S = OQ = p \cot H$.

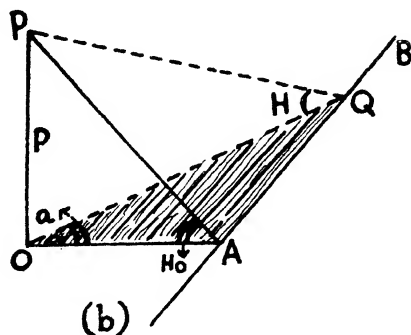


Fig. 10(b)

$$\begin{aligned}
 &= \frac{p \cot H_0}{\cos a} \quad \dots \quad \dots \text{by (5)} \\
 &= \frac{OA}{\cos a} \quad \dots \quad \dots \text{by (6)}
 \end{aligned}$$

But a is the angle QOA.

Therefore Q lies on AB drawn \perp OA at A on the ground.

Thus the locus of the end of the shadow is a straight line.

This phenomenon is too striking to have escaped the notice of the shadow-measurers. They would also have noticed that for some time immediately after sun-rise¹, the top of the pole does not cast any shadow at all, and then the shadow begins to appear at a certain distance. From this they must have concluded that celestial bodies move in rectilinear orbits, and appear to us only when they come within a certain distance.

CONCLUSION.

11. Thus it would appear that the ancient astronomers who were engaged in observing the Sun and the stars and measuring the shadows learnt to assign rectilinear orbits to the celestial bodies. This fitted in with their system of measurements based on square scales, and with their general scheme of things including their conceptions like the Universe based on the square form and their appliances like the gnomon and the Sun-dial of Ahaz. From an evolutionary stand-point the square appears to have given place to the circle, the intermediate stages being marked by the pentagon, hexagon, octagon, etc.² While the solar orbit and the zodiac—the path of all the planets—was conceived as a square in the beginning, they soon began to differentiate the forms of the orbits of the planets: the pentagram and the pentagon were assigned to the orbits of Mercury and Venus, the eight-pointed star for Rāhu, and other stars for other entities; these were the polygons which formed the Ideal fits to the respective orbits, any variations in observed values being treated as approximations or mere appearances. These 'realities' or secrets of the Universe were treasured as secrets and gave rise to various symbols of mysticism, occultism and art, and survived in astrology, alchemy, the Kabbala, and in rites of religion and magic.

¹ I.e., till the Sun comes up to the height of the pole.

² Cf. Menon, *op. cit.*, pp. 49-50, 69, 74, 89, 167.

Observations on two Myxosporidians *Zschokkella lissemysi* N.Sp. from the gall-bladder of the tortoise, *Lissemys punctata* and *Zschokkella auerbachii* (Weill) from the gall-bladder of *Bufo melanostictus*, with a note on the Genus *Zschokkella* Auerbach.

By MUKUNDAMURARI CHAKRAVARTY.

(Communicated by Dr. K. Biswas.)

INTRODUCTION.

In the course of examination of the gall-bladder of the tortoise *Lissemys punctata* caught from the tank of our college compound, I came across a new species of *Zschokkella*, *Z. lissemysi* which is described in this paper. I have also given here a detailed description of *Zschokkella auerbachii* (Weill). A discussion on the genus *Zschokkella* has also been attempted here.

The methods of preparation adopted here are the same as given by the author (1939) in his previous paper. The spores were studied and their measurements taken in fresh conditions. Permanent preparations were also made in order to study the different developmental stages of the parasites.

I am indebted to Dr. H. N. Ray for his helpful suggestions and for the slides which he prepared and placed at my disposal for further investigation. Thanks are due to Mr. D. Mukerji and Mr. J. L. Bhaduri who helped me in various ways. Thanks are also due to Mr. P. L. Misra of Lucknow University for sending me some slides which he prepared from the gall-bladder of *Rana limnocharis* found at Mukteswar (U.P.).

Genus *Zschokkella* Auerbach 1910.

Since there is a considerable difference of opinion as to the proper use of the generic names *Cystodiscus* and *Zschokkella* a brief account of these genera as given by previous authors is given here. The genera *Cystodiscus* and *Zschokkella* were established by Lutz (1889) and Auerbach (1910) respectively to receive the type species *C. immersus* and *Z. hildae*. Cordero (1919) who re-examined *C. immersus* was of opinion that its spores resemble those of the genus *Myxidium*. Thus according to him *Cystodiscus* becomes a synonym of *Myxidium*. Weill (1929), however, ignoring the observations of Cordero pointed out that the characters of the spores of the genera *Cystodiscus* and *Zschokkella* resemble one another so much that he revived the genus *Cystodiscus* and merged Auerbach's genus *Zschokkella*

in it but curiously enough he admitted that the latter is well defined. In his revision of the myxosporidian genera Kudo (1933), especially on the strength of Cordero's observations, included *C. immersus* in the genus *Myxidium* abolishing the genus *Cystodiscus* and retained *Zschokkella* as a distinct genus.

I am in entire agreement with Kudo's classification but the definition of the genus *Zschokkella* needs a little emendation especially in reference to the characteristics of the spores. In the definition it is stated that the ends of the spores are pointed but on referring to some species of *Zschokkella* so far described it has been found that they are rounded as in *Z. ovata* (Dunkerly) 1921, *Z. rovigensis* Nemecek 1922, *Z. parasiluri* Fujita 1927 and *Z. auerbachii* (Weill) 1929. The new species described in this paper also reveals rounded extremities of the spores. I therefore propose the following definition for the genus.

Genus *Zschokkella* Auerbach 1910 emend. Spore semi-circular in front view; ellipsoidal in profile. Ends pointed or rounded. Sutural line curved. Polar capsules large and spherical; polar filaments long and fine. Typically coelozoic in marine or fresh-water fish and also in amphibians and reptilians.

Zschokkella lissemysi n.sp.

Host:—*Lissemys punctata* (Bonnaterre).

Habitat:—Gall-bladder.

Locality:—Calcutta.

Vegetative form:—In the stained preparations of the contents of the gall-bladder of the host a large number of amoeboid uninucleate forms (Pl. 4, figs. 1 and 2) were encountered. The cytoplasm of these young trophozoites is vacuolar and no distinction could be made between the ectoplasm and endoplasm. The nucleus is spherical with a centrally placed karyosome and measures about 2μ in diameter. The young trophozoites measure $12.36-14.42\mu$ in length and $8.24-9.33\mu$ in their broadest part. Mature or sporulating trophozoites were unfortunately not seen.

Spore: In front view, the spores appear semicircular (Pl. 4, fig. 3) with one of their ends slightly tapering and so they sometimes appear egg-shaped. In the lateral view they are ovoidal (Pl. 4, fig. 4). On the flat surface of the spore and in between the polar capsules there is a lid (Pl. 4, fig. 3), which, when open, in all probability allows the sporoplasm to flow out. The valves of the spore are thick and striated, the striae being parallel. The sutural line and ridge could not be seen. The polar capsules are equal and spherical. The coiled filament of the capsules can easily be seen in fresh condition. Each capsule is provided with a fine duct (Pl. 4, fig. 3) which opens to the exterior by the side of the lid. The filament is extruded through this duct. The sporoplasm occupies the entire space of the spore between the polar capsules and in front view extends dorsally

like an umbrella over the capsules. It is clearly visible both in fresh and stained conditions. In stained preparations two nuclei of the sporoplasm are found (Pl. 4, fig. 5). Besides, two capsulogenous nuclei are attached to the two capsules.

Dimensions: length of the spore 18.5–22.6 μ , breadth of the spore 14.4–16.4 μ , polar capsules 7.2–9.2 μ in diameter, spore wall 2.06 μ thick, polar filament 100 μ in length.

Affinity.

Of all the species of *Zschokkella* so far known only one has been reported from the gall-bladder of Amphibia and the rest from the gall-bladder or urinary bladder or kidney of fishes. It is for the first time that *Z. lissemysi* is reported from the gall-bladder of a reptile. Its spores differ from those of all the known species of *Zschokkella* in the position of the polar capsules and in having a lid on the ventral wall of the spore by the sides of which the two ducts of the capsules open to the exterior. The spores of *Z. lissemysi* approach to those of *Z. hildae* Auerbach, and *Z. salvelini* Fantham, Porter and Richardson in size but differ in shape and in having rounded extremities. *Z. rovigneensis* Nemeček has spores equal in size with those of the parasite under report but differs in having one of the ends of the spores narrower than the other and in the presence of striations on the valves of the shell.

Zschokkella auerbachii (Weill).

Syn: *Cystodiscus auerbachii* Weill, 1929.

Zschokkella prasadi Ray, 1933a.

Cystodiscus sp. Ray, 1933.

Zschokkella auerbachii (Weill) was described in 1929 from the gall-bladder of *Bufo melanostictus* of the Indo-Chinese region. Ray (1933a) reported *Zschokkella prasadi* from the gall-bladder of *Bufo melanostictus* and *Rana tigrina* occurring in Calcutta but he published no description of the species. In the course of examination of the same hosts from the same locality as Ray (1933a) did, a species of *Zschokkella* was also observed by me to inhabit their gall-bladder. Ray very kindly handed over to me for further investigation the slides which he prepared and on comparing his preparations with those prepared by me, I find that these myxosporidians belong to the same species, as the shape and size of the spores as well as of the vegetative forms are exactly alike. Moreover the spores of the *Zschokkella* under report resemble very closely to those of *Z. auerbachii* (Weill) both in shape and size, although the size of the vegetative forms differs to a considerable extent. Thus, as the classification of myxosporidians are chiefly based on the characters of the spores, *Z. prasadi* as reported by Ray becomes synonymous with *Z. auerbachii*.

A careful examination of the preparations sent to me by P. L. Misra reveals that they are myxosporidians and this myxosporidian also resembles *Z. auerbachii* (Weill) in all essential features except that the spores are slightly bigger in size.

Description of *Zschokkella auerbachii* (Weill).

Host:—*Bufo melanostictus* Schneider, *Rana tigrina* Daud and *R. limnocharis* Wieg.

Habitat:—Gall-bladder.

Locality:—Calcutta and Mukteswar (U.P.).

Vegetative form:—The mature trophozoites (Pl. 4, figs. 6 and 7) are irregular, some being oval in shape, others are disc-shaped while a few have an elongated amoeboid form. The young trophozoites (Pl. 4, fig. 8) are, however, circular in outline having a large number of nuclei and vacuolated cytoplasm. The nuclei (Pl. 4, fig. 10) contain a chromatin granule at their centre and vary from 3.1 to 4.2 μ in diameter. Weill (1929) observed the difference between ectoplasm and endoplasm of the trophozoites, which, however, I failed to distinguish both in young and mature forms as well as in fresh and stained conditions. The outer wall of the trophozoites is composed of a thin, more or less hyaline matrix which is followed by a densely granular layer and a vacuolated inner layer (Pl. 4, fig. 9). The largest diameter of the circular and oval forms varies from 1.07 to 1.7 mm. while the elongated forms are 1 to 1.75 mm. in length and .39 to .5 mm. in width. The thickness of the trophozoites varies from 15–30 μ . The size of the trophozoites given above differs very widely from those given by Weill.

Cell differentiation becomes marked with the growth of the parasites. Some of the cells (Pl. 4, fig. 12) develop into pansporoblasts which become differentiated first at the periphery of the trophozoites. As many as twelve nuclei could easily be counted within a pansporoblast (Pl. 4, fig. 13). Each pansporoblast gives rise to two sporoblasts (Pl. 4, figs. 14–16), each of which forms a single spore. Fully formed trophozoites contain a large number of spores which most probably escape by the rupture of the plasmodial forms. Hence the trophozoites are polysporous, the pansporoblasts disporoblastic and the sporoblasts monosporic.

Endogenous buds (Pl. 4, fig. 7) are developed within the developing plasmodial forms. First they appear as small uninucleate cells. The nucleus by its further division gives rise to a number of nuclei of uniform shape and size. When the endogenous buds attain the size of 40–60 μ in diameter they migrate towards the periphery of the trophozoites and finally separate from the mother plasmodial form. Weill observed plasmogamy, which, however, was not seen by me.

Spore: The spores resemble the description given by Weill (1929). In front view, they are more or less semicircular (Pl. 4,

fig. 17) and ovoidal (Pl. 4, fig. 18) in side view. Both the ends of the spore are round, one of them is, however, narrower than the other. The shape of the spores appears different when viewed from different angles and this might have led Ray (1933) to call it a new species other than *Z. auerbachii*. The shell is thin and the valves are marked with striations. The sutural ridge is prominent and runs obliquely. The polar capsules are spherical being equal in size and they show distinctly coiled filaments in living conditions. The sporoplasm, which can equally be distinguished both in fresh and stained spores, is situated on the dorsal side of the spore and extends ventrally between the two polar capsules. It appears granular if the spores are stained and contains one or two nuclei (Pl. 4, figs. 20 and 21). The mononucleate spores are no doubt derived from the binucleate ones by the fusion of their nuclei. The size of the spores is approximately the same as given by Weill.

Dimensions : length of the spore 10.3μ , breadth of the spore 6.18μ , polar capsules 4.12μ in diameter, filament of the polar capsules $40-50\mu$ in length. Dimensions of the spores obtained from *R. limnocharis*: length $12.36-14.42\mu$, breadth $6.18-8.24\mu$, polar capsules $4.12-5.21\mu$.

The table below shows a comparison between the original description given by Weill and the description given in this paper.

Vegetative Form.			Spore.		
	Shape.	Size.	Shape.	Size.	Polar capsules.
Description given by Weill.	Discoidal; difference between ectoplasm and endoplasm.	$50-180\mu$ in diameter.	Regularly sub-spherical with angles rounded when seen from the side and ellipsoidal when seen from the surface.	$11\mu \times 6\mu$.	Spherical in shape; 3μ in diameter; polar filaments $89-90\mu$ long.
Description given by the present author.	Irregular; no difference between ectoplasm and endoplasm.	$1000-1750\mu$ in longest diameter.	Semicircular in side view; angles rounded but one end slightly tapering; ovoidal in side view.	$10.3\mu \times 6.18\mu$ and $12.36-14.42\mu \times 6.18-8.24\mu$.	Spherical in shape; 4.12μ in diameter; polar filament $40-50\mu$ long.

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* Original paper not seen.

EXPLANATIONS OF PLATE.

Figures were drawn under a camera lucida and magnified 1666 times, unless otherwise stated.

Zschokkella lissemysi n.sp., figs. 1-5.

Figs. 1 and 2. Young trophozoites from a stained smear.

Fig. 3. Front view of a fresh spore, showing the position of the polar capsules with their ducts and the lid.

FIG. 4. Side view of a fresh spore, showing the striations on the shell.

FIG. 5. A spore from a stained smear.

Zschokkella auerbachii (Weill), figs. 6-21.

Figs. 6 and 7. Microphotographs of two stained mature trophozoites.

Note in fig. 7, the endogenous buds, one of which is seen to separate from the mother plasmodial form on the right hand side. $\times 54$.

FIG. 8. Microphotograph of a stained young trophozoite. $\times 710$.

FIG. 9. Part of a stained trophozoite in section to show the three layers.

FIG. 10. A vegetative nucleus from a stained smear.

FIG. 11. A dividing vegetative nucleus from a stained smear.

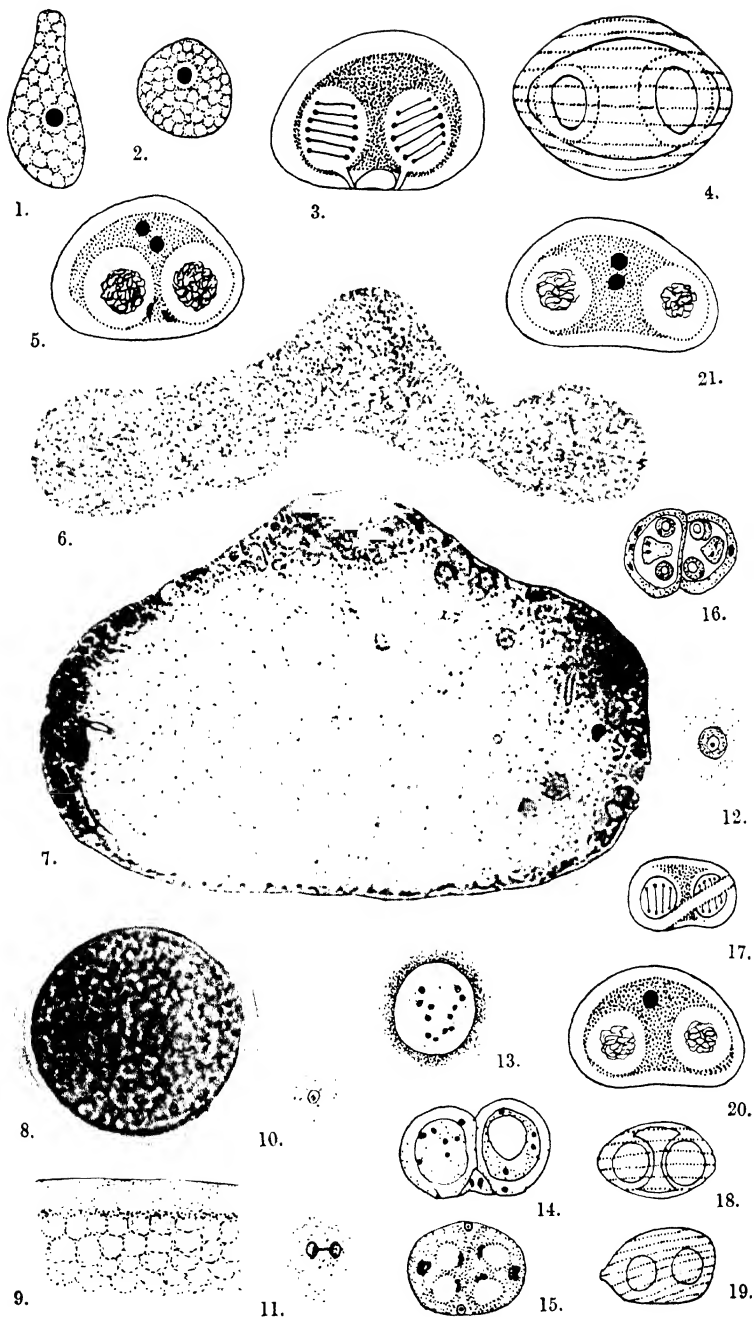
Figs. 12-16. Development of spore from a stained smear; fig. 12 uninucleate pansporoblast; fig. 13 pansporoblast showing twelve nuclei; fig. 14 pansporoblast differentiated into two sporoblasts; figs. 15 and 16, development of a single spore within each of the sporoblasts.

FIG. 17. Front view of a fresh spore.

FIG. 18. Side view of a fresh spore.

FIG. 19. A fresh spore showing striations on the shell.

Figs. 20 and 21. Two stained spores from a stained smear. $\times 3500$.



On a Collection of Fish from Kalimpong Duars and Siliguri Terai, Northern Bengal.¹

By SUNDER LAL HORA and J. C. GUPTA.

In 1938, Messrs. G. E. Shaw and E. O. Shebbeare published in the *Journal* of the Society (*Science*, III, pp. 1-137, text-figs. 1-130, pls. i-vi, 1937, December 1938) an illustrated account of the 'Fishes of Northern Bengal' and listed 131 species, a few of which are stated to be exotic as they had been purchased only from the markets at Siliguri and similar other places served by railway. All the same, the indigenous species of this region certainly number over one hundred. It has long been recognized that the fish-fauna of the Eastern Himalayas and the Assam Hills is very rich, for this area forms a meeting place of the Indo-Chinese, Indo-Malayan and Indian elements of the fish-fauna of the Oriental Region. The study of the fishes of northern Bengal is, therefore, of special interest from a zoogeographical point of view. Moreover, a fair number of freshwater species described by Hamilton in his *Gangetic Fishes* were obtained from northern Bengal and to elucidate their precise taxonomic position one has to rely, in the absence of types, on topotypes. In view of these considerations, the Zoological Survey of India had been trying for some years to obtain well preserved specimens of fishes from this region for its collection in the Indian Museum. However, a good opportunity to study this fauna occurred when in November-December, 1938, one of us (S. L. Hora) led a party of the Zoological Survey of India to the Kalimpong Duars and the portion of the Terai in the Siliguri Sub-Division of the Darjeeling District, and collections of fish were made from a large number of small streams, ponds and ditches. The party visited Mongpong, Chunbhati, Ghish and Burrikhola in the Kalimpong Duars, and Siliguri, Sevoke, Kalijhora, Naksalbari and Kharibari in the Siliguri Sub-Division.

The country surveyed was almost level or slightly undulating here and there, but it was cut up by innumerable small streams and *nallahs* which carry large volumes of water during the rains but become reduced to a small stream or a mere trickle during the dry season. Some of the streams flowed through vast arid expanses, while the valleys of others were well shaded with thick forests. The beds of these streams were often pebbly or sandy and only in a few cases the sides were steep and rocky.

¹ Published with permission of the Director, Zoological Survey of India.

Here and there deep pools occurred, but generally the water was clear and shallow. There was very little aquatic vegetation except for algae covering rocks or stones, or floating in side-pools.

From the types of localities visited by the party, the fish-fauna can be divided into two principal ecological associations. The first association comprises pool-dwelling forms, such as *Danio aequipinnatus* (McClelland), *D. dangila* Hamilton, *D. devario* Hamilton, *Brachydanio rerio* (Hamilton), *Esomus danricus* (Hamilton), *Barbus (Puntius) conchoni* Hamilton, *B. (Puntius) sophor* Hamilton, *B. (Puntius) ticto* Hamilton, *Mystus vittatus* (Bloch), *Xenentodon cancila* (Hamilton), *Ambassis ranga* (Hamilton), *Badis badis* (Hamilton), *Ophicephalus gachua* Hamilton, *O. punctatus* Bloch, *Colisa chuna* (Hamilton), etc., etc. These can be further divided into two categories—those that live in clear water pools in the course of the streams and those that live in stagnant pieces of water. Some of the species are adapted to both types of habitats. The second association comprises those species that live in shallow swift currents, and here again we have certain fishes, such as loaches and loach-like catfishes which live among pebbles at the bottom, and certain others which live in rapids by sheer muscular efforts. The fishes of the second category comprise Mahseers, of which three distinct types were collected by the party.

In making a collection of fishes, small streams were dammed across and their waters diverted. In the drying up channels below the dams a great variety of fishes were collected by turning over rocks and stones. A small bag-net was also used in catching fish from ponds and ditches, and deeper parts of streams. Attention may also be directed to the fact that almost all the species in the collection are represented by very young specimens which shows that the fish in this part of the country breed during or immediately after the monsoon months.

The following species of fish were obtained by the party:—

Family: CYPRINIDAE.

Subfamily: ABRAMADINAE.

1. *Chela bacaila* Hamilton.

Subfamily: RASBORINAE.

2. *Barilius barna* Hamilton.
3. *Barilius benedosis* Hamilton.
4. *Barilius (Opsarius) bola* Hamilton.
5. *Barilius shacra* Hamilton.
6. *Barilius vagra* Hamilton.
7. *Danio aequipinnatus* (McClelland).
8. *Danio dangila* Hamilton.
9. *Danio devario* Hamilton.

10. *Danio (Brachydanio) rerio* Hamilton.
11. *Esomus danricus* (Hamilton).

Subfamily: CYPRINAE.

12. *Aspidoparia jaya* (Hamilton).
13. *Aspidoparia morar* (Hamilton).
14. *Barbus (Chagunius) chagunio* (Hamilton).
15. *Barbus (Puntius) conchoni* Hamilton.
16. *Barbus (Lissochilus) hexagonolepis* McClelland.
17. *Barbus (Tor) putitora* (Hamilton).
18. *Barbus (Puntius) sarana* (Hamilton).
19. *Barbus (Puntius) sophore* Hamilton.
20. *Barbus (Puntius) ticto* Hamilton.
21. *Barbus (Puntius) titius* Hamilton.
22. *Barbus (Tor) tor* (Hamilton).
23. *Crossochilus latius* (Hamilton).
24. *Garra annandalei* Hora.
25. *Garra gotyla* (Gray).
26. *Labeo dero* (Hamilton).
27. *Labeo dyocheilus* (McClelland).
28. *Semiplotus semiplotus* (McClelland).

Subfamily: SCHIZOTHORACINAE.

29. *Oreinus molesworthii* Chaudhuri.

Family: PSILORHYNCHIDAE.

30. *Psilorhynchus balitora* (Hamilton).
31. *Psilorhynchus sucatio* (Hamilton).

Family: COBITIDAE.

32. *Aborichthys elongatus* Hora.
33. *Acanthophthalmus pangia* (Hamilton).
34. *Lepidocephalus guntea* (Hamilton).
35. *Nemachilus beavani* Günther.
36. *Nemachilus botia* (Hamilton).
37. *Nemachilus devdevi* Hora.
38. *Nemachilus rupicola* var. *inglisi* Hora.
39. *Nemachilus savona* (Hamilton).
40. *Nemachilus scaturigina* (McClelland).
41. *Somileptes gongota* (Hamilton).

Family: OLYRIDAE.

42. *Olyra longicaudata* McClelland.

Family: SILURIDAE.

43. *Silurus cochinchinensis* Cuvier and Valenciennes.

Family: SCHILBEIDAE.

44. *Clupisoma garua* (Hamilton).

Family: BAGRIDAE.

45. *Batasio batasio* (Hamilton).

46. *Batasio tengana* (Hamilton).

47. *Mystus vittatus* (Bloch).

Family: AMBLYCEPIDAE.

48. *Amblyiceps mangois* (Hamilton).

Family: SISORIDAE.

49. *Laguvia shawi* Hora.

Family: XENENTODONTIDAE.

50. *Xenentodon cancila* (Hamilton).

Family: AMBASSIDAE.

51. *Ambassis baculis* (Hamilton).

52. *Ambassis ranga* (Hamilton).

Family: NANDIDAE.

53. *Badis badis* (Hamilton).

Family: GOBIIDAE.

54. *Glossogobius giuris* (Hamilton).

Family: OPHICEPHALIDAE.

55. *Ophicephalus gachua* Hamilton.

56. *Ophicephalus punctatus* Bloch.

Family: OSPHRONEMIDAE.

57. *Colisa chuna* (Hamilton).

Family: MASTACEMBELIDAE.

58. *Mastacembelus armatus* (Lacépède).

To the species listed by Shaw and Shebbeare from northern Bengal, we have added three more species, viz. *Barbus* (*Tor*) *tor* (Hamilton),¹ *Batasio tengana* (Hamilton),² and *Ambassis baculis* (Hamilton). *Barbus* (*Lissochilus*) *hexagonolepis* McClelland³ of our list is the same as *Barbus dukai* Day of the list of Shaw and Shebbeare, *Barbus* (*Puntius*) *sophore* Hamilton⁴ is the same as *B. stigma* (Cuv. and Val.), and *Olyra longicaudata* McClelland⁵ is the same as *O. kempfi* Chaudhuri. In the course of our revision we have also found it necessary to make alterations in the generic or subgeneric names of certain species listed by Shaw and Shebbeare; these are *Barilius* (*Opsarius*) *bola*

¹ Hora, S. L.—*Journ. Bombay Nat. Hist. Soc.*, XLI, pp. 518–525, 3 pls., 1 text-fig. (1940).

² Hora, S. L. and Law, N. C.—*Rec. Ind. Mus.*, XLIII, pp. 36–39, pl. ii, figs. 1–3, (1941). The taxonomic position of *Batasio* (Blyth) is also discussed in this article.

³ Hora, S. L.—*Journ. Bombay Nat. Hist. Soc.*, XLII, pp. 78–88, 1 pl., 4 text-figs. (1940).

⁴ Chaudhuri, B. L.—*Mem. Ind. Mus.*, V, pp. 436–438 (1916).

⁵ Hora, S. L.—*Rec. Ind. Mus.*, XXXVIII, pp. 202–207 (1936).

Hamilton,¹ *Barbus* (*Chagunius*) *chagunio* (Hamilton),² *Clupisoma garua* (Hamilton),³ and *Colisa chuna* (Hamilton). Further, it has been found that *Lepidocephalus annandalei* Chaudhuri is a juvenile colour form of *L. guntea* (Hamilton). Notes on the variation of the dorsal spine of *Semiplotus semiplotus* (McClelland) and on the systematic position of *Barbus* (*Puntius*) *titius* Hamilton are given. In well preserved specimens of *Laguvia shawi* Hora there is a distinct adhesive pad in the chest region similar to that of the species of *Glyptothorax* Blyth.

Lepidocephalus guntea (Hamilton).

1878. *Lepidocephalichthys guntea*, Day, *Fish. India*, p. 609, pl. clv, fig. 4.
 1912. *Lepidocephalichthys annandalei*, Chaudhuri, *Rec. Ind. Mus.*, VII, p. 442, pl. xl, figs. 3, 3a, 3b.
 1938. *Lepidocephalichthys annandalei*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal, Science*, III, p. 67, text-fig. 64.
 1938. *Lepidocephalichthys guntea*, Shaw and Shebbeare, *ibid.*, p. 68, text-fig. 65, pl. ii, fig. 2.

Lepidocephalus guntea is represented in the collection by a very large number of specimens. As has been noted by previous workers, the colouration varies considerably with the size and habitat of the individuals. In a number of young specimens, there are two ocelli in connection with the caudal fin which are situated exactly in the same positions as described by Chaudhuri for his *L. annandalei*. In other respects also the colouration of the juvenile examples agrees with that of Chaudhuri's species. For these reasons we regard the two species as conspecific.

Semiplotus semiplotus (McClelland).

1937. *Semiplotus semiplotus*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal, Science*, III, p. 59, text-fig. 56, pl. v, fig. 8.
 1937. *Semiplotus semiplotus*, Hora, *Rec. Ind. Mus.*, XXXIX, pp. 45, 46.

Semiplotus semiplotus is represented in the collection by 15 young examples ranging in standard length from 17 to 107 mm. All the specimens possess small maxillary barbels which are more pronounced in smaller individuals (*vide* Hora, *loc. cit.*, pp. 45, 46). In the three specimens collected from the Joyranti Stream, 33 to 38 mm. in standard length, the distal half of the dorsal spine is slightly serrated, but in all other respects they agree with the remaining young examples, in which the dorsal spine is smooth throughout. The dorsal spine

¹ Hora, S. L.—*Journ. Bombay Nat. Hist. Soc.*, XXXIX, pp. 199–210, 1 pl., 3 text-figs. (1937).

² Smith, H. M.—*Proc. Biol. Soc. Washington*, LI, pp. 157, 158 (1938).

³ Hora, S. L.—*Journ. Bombay Nat. Hist. Soc.*, XXXIX, pp. 659–678, 1 pl., 9 text-figs. (1937).

is also slightly serrated in a specimen, about 67 mm. in length, from the Mahanadi River.

In connection with the structure of the dorsal spine noted above, attention may be directed to the fact that the only other species of the genus, *S. modestus* Day¹ from Burma, is characterized by a serrated dorsal spine. It seems probable that the serrated dorsal spine in the juvenile examples of *S. semiplotus* referred to above is an embryonic or atavistic character, and indicates that *S. modestus* is probably a less specialized member of the genus than *S. semiplotus*.

Barbus (Puntius) titius Hamilton.

1822. *Cyprinus titius*, Hamilton, *Fish. Ganges*, p. 315.
 1839. *Systemus tetrapagus*, McClelland, *Ind. Cyp.*, pp. 285, 381, pl. xlv, fig. 3.
 1868. *Barbus titius*, Günther, *Cat. Fish. Brit. Mus.*, VII, p. 154.
 1878. *Barbus tetrapagus*, Day, *Fish. India*, p. 572, pl. cxlii, fig. 5.
 1889. *Barbus tetrapagus*, Day, *Faun. Brit. Ind., Fish.*, I, pp. 318, 319.
 1937. *Barbus titius*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal, Science*, III, p. 44, text-fig. 39, pl. v, fig. 5.
 1939. *Barbus tetrapagus*, Das, *Rec. Ind. Mus.*, XLI, p. 441.
 1940. *Barbus (Puntius) tetrapagus*, Hora, *Rec. Ind. Mus.*, XLII, p. 370.

Cyprinus (Puntius) titius was 'found in ponds near Calcutta', but insufficiently characterized by Hamilton, who on account of its utmost resemblance with *C. ticto* 'did not think it necessary to take a drawing or particular description of the Calcutta kind'. However, he distinguished the species mainly on the position of colour spots; in *C. ticto* there is 'one black spot on the lateral line above each pectoral fin, and another near the end of the tail; and with the back fin spotted', while *C. titius* is provided 'with two black spots on each side, near the lateral line; with no spots on the dorsal fin'. Another important difference that can be readily made out from Hamilton's descriptions of the two species is in the nature of their dorsal spine; in *C. ticto* it is indented behind while in *C. titius* it is smooth. McClelland doubtfully referred *C. titius* to his *Systemus tetrapagus* which he characterized by the possession of 'a black spot on either side behind the opercula and another at the end of the tail' and remarked (foot-note, p. 285) '*Cyprinus ticto* (Bach). P.G. t.8.f.87, is nearly allied to this species, but shorter'. Though Günther regarded Hamilton's species as valid, with *Systemus tetrapagus* as its synonym, Day considered both the species doubtful. However, Day adopted the specific name *tetrapagus* for describing this species. Recently Das and Hora followed Day, but Shaw and Shebbeare had rightly described the species under its original name.

¹ Day, F.—*Fish. India*, p. 550, pl. cxxxiii, fig. 1 (1877).

B. (Puntius) titius is a characteristic species and is represented in the collection by two adult specimens 56 mm. and 68 mm. in standard length respectively; it can be readily distinguished by its colour spots. According to Day, *B. tetrapagus* it is found in 'Orissa, Bengal, Assam, N.W. Province, Punjab, and Sind, also the Deccan'.

SUMMARY.

Attention is directed to the great importance of the study of the fish-fauna of the Eastern Himalayas and notes are given on the physical conditions of the parts of the Kalimpong Duars and of the Siliguri Terai in which collections were made. The fish-fauna is roughly divided into ecological associations and a reference is also made to the methods of collecting fish.

A list of 58 species is given and additions and alterations made in a list of 131 species of fish of northern Bengal published by Messrs. Shaw and Shebbeare in 1938 are explained. Taxonomic notes are given on *Lepidocephalus guntea* (Hamilton), *Semiplotus semiplotus* (McClelland), and *Barbus (Puntius) titius* Hamilton.

A Note on the History of Bacteriology and some of the Early Workers in India.

By MAJOR C. L. PASRICHA, I.M.S.

This short communication is prepared from some notes and analyses made during the course of reading Bulloch's (1938) history of bacteriology. At the end of this excellent and valuable book there are biographical notices of some of the early workers in bacteriology. In this are listed 330 bacteriologists and others whose work contributed to the development of bacteriology. The nationality of these pioneer workers was analyzed and is given in Table I.

TABLE I.

The Nationality of the 330 Early Workers in Bacteriology.

Nationality.	Number.	Percentage of total.
German	113	34.24
English	58	17.58
French	55	16.66
American	24	7.27
Austrian	16	4.85
Italian	15	4.55
Danish	8	2.42
Russian	8	2.42
Hungarian	5	1.51
Japanese	5	1.51
Swiss	4	1.21
Dutch	3	0.91
Belgian	3	0.91
Canadian	2	0.6
Rumanian	2	0.6
Polish	2	0.6
Portuguese	1	0.3
Spanish	1	0.3
Norwegian	1	0.3
Ukrainian	1	0.3
Yugo-Slavian	1	0.3
Lithuanian	1	0.3
Maltese	1	0.3

TABLE II.

The number of workers in each decade (except the last decade) during the nineteenth century.

Decade ending.	German.	English.	French.	American.	Austrian.	Italian.	Danish.	Russian.	Hungarian.	Japanese.	Swiss.	Dutch.	Belgian.	Canadian.	Rumanian.	Polish.	Portuguese.	Spanish.	Norwegian.	Ukrainian.	Yugo-Slavian.	Lithuanian.	Maltese.	Total.
1810	8	..	5	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14
1820	4	5	5	1	..	2	1	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	20
1830	5	4	5*	..	* Pasteur born.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14
1840	12	2	6	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
1850	26	7	8	2	2	1	2	1	2	..	..	..	..	..	..	1	..	1	1	..	1	..	..	55
1860	32	13	8	8	5	5	1	3	1	2	2	1	1	..	..	1	..	..	..	1	..	..	..	84
1870	14	18	6	8	6	1	2	3	..	1	1	..	1	1	..	..	1	..	..	..	..	..	1	64
1880	5	5	..	4	1	1	..	..	1	2	..	..	..	1	1	..	..	..	..	..	..	1	..	22
1890	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	2
Total	107	54	43	24	14	10	6	7	5	5	4	2	2	2	2	2	1	1	1	1	1	1	1	296

The rapid development of bacteriology in the second half of the nineteenth century is well seen in Table II in which is given the number of workers in successive decades during the 19th century (except the last decade). It is interesting to note that a marked increase in the number of workers occurs two decades after the birth of Pasteur.

There are listed 29 workers born earlier than 1800 (one each in the 15th and 16th centuries, nine in the 17th century and eighteen in the 18th century). There are five workers whose date of birth is unknown leaving a total of 296 workers born in the 19th century. These have been analyzed according to their nationality and the decade in which they were born.

Of the 330 early workers in bacteriology listed by Bulloch seventeen came to India. These workers are listed below alphabetically together with some notes of the work done by them and references where further information can be found.

EARLY WORKERS IN BACTERIOLOGY WHO CAME TO INDIA.

1. CARTER, HENRY VANDYKE (British, born 1831, died 1897).

Joined the Indian Medical Service in 1858 and was Professor of Anatomy and Physiology in Grant Medical College, Bombay (from 1858 to 1863). Worked at leprosy, mycetoma, surra, malaria and relapsing fever. Whilst a demonstrator of anatomy in St. George's Hospital drew the illustrations for Gray's Anatomy. In an obituary notice in the British Medical Journal (1897) is found a true epitaph of this worker. 'Carter devoted his life, his talents, his pen and his pencil unsparingly and unflaggingly to the service of science and of India'. In recognition of his work on relapsing fever Carter received the Stewart Pathological Prize of £500 awarded by the British Medical Association.

Brit. Med. Journ., 1897 (i), 1256.

Lancet, 1897 (i), 1381.

2. CUNNINGHAM, DAVID DOUGLAS (British, born 1843, died 1914).

Entered the Indian Medical Service in 1868 and in company with Lewis went to Germany to learn the views and master the technique of Hallier and De Bary, and to work for a time under Pettenkofer at Munich. Cunningham and Lewis reached Calcutta in 1869 and for the next ten years both were engaged in important pathological and hygienic studies. With Timothy Lewis made exhaustive study of cholera in India. Cunningham became Professor of Physiology and for a time also of Pathology in Calcutta Medical College. During his residence in India Cunningham was at frequent intervals a councillor of the Asiatic Society of Bengal. He was for many years one of the trustees of the Indian Museum and an active member (later the Chairman) of the committee of management of the Calcutta Zoological Garden. It was on his suggestion and in accordance with his plans that a research laboratory was established in the Zoological gardens. He was elected F.R.S. in 1889, awarded C.I.E. in 1893 and retired in 1899.

Brit. Med. Journ., 1915 (i), 98 and 141.

Proc. Roy. Soc. London, 1916, B LXXXIX, 15-20.

3. DOUGLAS, STEWART RANKEN (British, born 1871, died 1936).

Joined Indian Medical Service 1898. Served in China expedition 1900-1. Retired from the I.M.S. with rank of Captain. Came into close association with Sir Almroth Wright and worked with him for several years. Studied the serological grouping of vibrios. Later became Director of Bacteriological Department of the National Institute of Medical Research. F.R.S. in 1922.

Lancet, 1936 (i), 229.

4. FISCHER, BERNHARD (German, born 1852, died 1915).

Assistant to Koch in Berlin and came with him on the Cholera Commission to India (1883).

Deut. med. Woch., 1915, xli, 1165.

5. GAFFKY, GEORGE (German, born 1850, died 1918).

Pupil, assistant, and successor of Robert Koch in Berlin. Accompanied Koch on German Cholera Commission to India (1883). Studied cholera in Hamburg 1892. Head of the German Plague Commission in India, 1897.

Berl. Klin. Woch., 1918, lv, 1062.

Deut. med. Woch., 1918, xlv, 1199.

Munch. med. Woch., 1918, lxxv, 1191.

6. HAFKINE, WALDEMAR MORDECAI WOLFF (Ukrainian, born 1860, died 1930).

Trained in Pasteur Institute, Paris, (1888-93) during a time when special study was being made of the preparation of vaccines and their application to prophylactics. An immense impetus had been given to this line of research by Pasteur's great experimental demonstration of the value of his vaccine against anthrax. Haffkine arrived in Calcutta in March 1893 and from here he travelled across to different places in India. In the first year he inoculated about 25,000 persons with his cholera vaccine. In 1894 he returned to Calcutta and carried out a large number of inoculations. In 1896 Haffkine went to Bombay and there produced a plague prophylactic vaccine and used it on a gigantic scale. Haffkine's name will always be associated with both cholera and plague prophylaxis. Founded Government Research Laboratory (now Haffkine Institute), Bombay. Retired in 1915.

Brit. Med. Journ., 1930 (ii), 801.

7. HANKIN, ERNEST HANBURY (British, born 1865).

Wrote early papers on nature of immunity and alexins. Was Chemical Examiner and Bacteriologist to the United Provinces and to the Central Provinces and worked on cholera, particularly the isolation of vibrios from natural waters and noted 'degenerative' forms of vibrios. He also worked on the epidemiology of plague.

8. D'HERELLE, FELIX HUBERT (Canadian, born in Montreal, 1873).

Chiefly known for his work on bacteriophage. Came to India in 1928 when during his short stay he worked extensively on cholera and dysentery bacteriophages.

9. KOCH, ROBERT (German, born 1843, died 1910).

The greatest pure bacteriologist and as Nuttall puts it 'In the annals of medicine his name should be enrolled with the immortals'. Koch first came to India in 1883 and he was one of the first to suggest that human malaria is transmitted

by mosquitoes. It was Koch who first advocated the systematic use of quinine in combating malaria, for he conceived that this disease could be eradicated by discovering the infected persons in a community and subjecting them to radical treatment thereby ridding them of parasites and rendering them no longer capable of infecting the anopheline vectors. Koch continued his study of cholera and in Calcutta he confirmed and extended the observations begun in Egypt and was able to announce the discovery of the cholera vibrio. Koch's work on cholera has scarcely been surpassed to this day. It must be remembered that he worked as a pioneer with the simplest of means. Considering the very great importance of this discovery which paved the way to a clear understanding of the etiology and prevention of this one of the most important scourges of India, it is to be regretted that there exists no memorial to commemorate the great service Koch rendered to this country. In 1896 at the age of 53 Koch came again to India, this time to Bombay as the head of the German Plague Commission.

Journ. Path. and Bact., 1910-11, XV, 108.

Parasitology, 1924-25, XVI, 214-38.

Proc. Roy. Soc., 1910-11, LXXXIII, Supp. 18-24.

10. LAMB, GEORGE (British, born 1870, died 1911).

Member of the Indian Medical Service. Came to India in 1894. Later assistant to Haffkine in Bombay and made important studies of snake venoms. Subsequently became Director of Pasteur Institute in India and initiated important modifications in the treatment of hydrophobia. Lamb carried out extensive investigations on Malta fever in India, on transmission of plague by fleas, and on rabies. For his work on plague he received the Stewart Prize awarded by the British Medical Association.

Journ. Hyg. (Plague Suppl.), 1912, XII, 2.

Journ. Path. and Bact., 1911, XVI, 119.

Brit. Med. Journ., 1911 (i), 969, 1029.

11. LEISHMANN, WILLIAM BOOG (British, born 1865, died 1926).

Joined the Royal Army Medical Corp., 1887. Rose to be Director-General of Army Medical Services. It was during his service in India that he began to take a close interest in bacteriology, especially in relation to dysentery with which he found himself in perpetual contact. Whilst stationed at Netley came under the influence of Almroth Wright. He assisted Wright in the early work on typhoid vaccine and made some investigations into Malta fever, a disease which later he contracted himself in the laboratory. It was here that whilst working with Wright on vaccine therapy that Leishmann introduced his stain which has now superseded its predecessor, the Romanowsky stain. Distinguished for his work on the value of anti-typhoid inoculation, phagocytosis and Leishmaniasis. F.R.S. in 1910.

Lancet, 1926 (i), 1171-3.

12. LEWIS, TIMOTHY RICHARDS (British, born 1841, died 1886).

Joined Army Medical Service and came to India (1869). He studied cholera in collaboration with Cunningham. In 1870 gave the first authentic account of amoebae from the human intestine found in cholera evacuations. In 1872 he gave the first account of '*Filaria sanguinis hominis*'. He

gave the first description of rat trypanosoma now called *T. lewisi*.

Parasitology, 1923, xiv, 413.

Ind. Med. Gaz., 1886, XXI, 179, 249.

Brit. Med. Journ., 1886 (i), 1242.

Nature, 1886, xxxiv, 76.

13. LUSTIG, ALESSANDRO (Italian, born 1857, died 1937).

Studied plague in India and introduced a method of preventive inoculation against this disease.

Garz. d. osp., 1937, LVIII, 960.

14. MARTIN, CHARLES JAMES (British, born 1866).

Studied plague particularly the mechanism of the transmission of plague by fleas. Was a member of the Plague Advisory Committee. He also worked on the insect porters of bacterial infections.

15. PFEIFFER, RICHARD (German, born 1858).

1896 served on the German Plague Commission in India. Discovered specific lysis of cholera (Pfeiffer's reaction).

Munch. Med. Woch., 1928, LXXV, 524.

16. ROWLAND, SYDNEY DOMVILLE (British, born 1872 died 1917).

Came to India 1905 as a member of the Advisory Committee for Plague Investigation in India and worked in the laboratory at Parel. His more special share in the activities of the working Commission in India was the laboratory work on the relation between fleas and plague. Later in England worked in the preparation of curative sera for plague.

Journ. Path. and Bact., 1916-17, XXI, 453.

Lancet, 1917, (i), 552.

17. WRIGHT, ALMROTH EDWARD (British, born 1861).

1898-1900 Member of Indian Plague Commission when with Dr. Ruffer wrote an important note of dissent (on the measures for the discovery of plague deaths) to the conclusions arrived at by the Indian Plague Commission. Pioneer in typhoid inoculations and developed the subject of therapeutic immunization generally. Responsible also for the training of a band of workers who were imbued with enthusiasm for research by coming in contact with Almroth Wright. Many of the workers in India owed much to the inspiration gained from this teacher.

It was hoped to write of these workers at greater length, to make fuller summaries of the work done by them and to build up a connected story, but other engrossing, more important and urgent duties render this impossible for the present. Suffice it to say that each one of them has left an indelible mark upon the annals of research and discovery in relation to infectious diseases of man and animals. The work done by these pioneer workers has borne, is bearing and will bear much fruit. To take but one instance it was Koch's discovery of the cholera vibrio and the pioneer work of Wright and Leishmann with typhoid vaccine that led to the subsequent large-scale trials under controlled conditions of cholera vaccine by Haffkine. These experiments contributed in no small measure to the establishment of the

value of vaccines as prophylactic agents in the controlling of large epidemic diseases. If it were possible to reckon up the sum of human lives that have been saved from premature death by this procedure alone the total would attain gigantic proportions. India has played an important rôle in two ways, firstly the presence of epidemic diseases and secondly the facilities for large scale trials under controlled conditions and with reasonable facilities for collecting data. The fact that of the 330 early workers who have found place in Bulloch's history of bacteriology seventeen workers came to India is sufficient justification for India to feel proud of the facilities that she has been able to offer these workers and thus to the development of the science of bacteriology. For her part India and her present-day workers should ever keep these men in grateful memory.

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- BULLOCH, W., (1938). *The History of Bacteriology*, p. 349 *et seq.*, Oxford University.



Life-History and Wanderings of *Hilsa* in Bēngal Waters.¹

By SUNDER LAL HORA.

"To study the wants of a people, to inquire into the history, language, habits, and customs of a nation, is generally deemed a duty on the part of its rulers: but hardly any objects of research are more worthy of the attention of a Government than the sources whence the food of the population is derived, or the nature of the articles most adapted for its manufacturing processes, or best fitted in the raw state for its home or foreign trade. In India the details of Native agriculture have been carefully studied, if they have not been improved; the earth has been ransacked for its minerals; the forests have been explored for their timber; the land for its agricultural capabilities, even the atmosphere for its meteorological variations; and in all these matters Government has wisely shown its interest; but the fish with which the fresh waters of Hindustan teem, and which abound in the seas that wash her coasts, have rarely met with attention from those in authority, or even from individuals whose private tastes have led them towards the cultivation of zoological science."

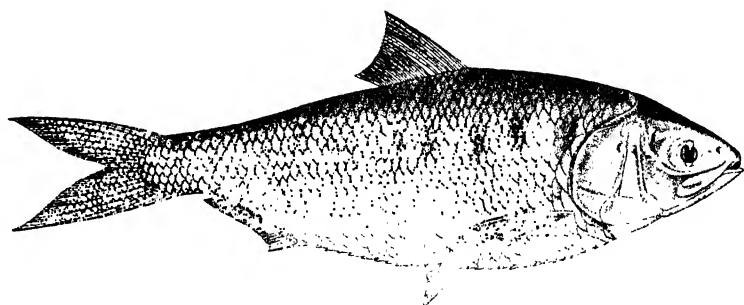
Francis Day, "The Fishes of Malabar", p. vii (London: 1865).

In Bengal, it can be stated, without the least fear of contradiction, that *Hilsa* is undoubtedly the most important edible fish, whether from the point of view of the numbers caught or in view of the esteem in which it is held by the fish-eating population of the province. Although the *Hilsa* season proper lasts only for a few months during the rains the oily nature and delicious flavour of the fish, in spite of the numerous little bones which it contains, make it a most acceptable article of diet for the rich and the poor alike. Though Carp, such as Rohu, Catla, Mrigal, Calbausa, Bata, etc., are perhaps collectively of greater economic importance, no single species can claim to have the same fishery value for this province as *Hilsa*. It is essentially a marine fish of the Herring family; and, in view of its periodic ascent into the fresh waters, is known as the Indian Shad. The species, as at present understood, is known from the Persian Gulf, where it ascends into the Tigris River; from the Coast of Sind, where it is known as *Pulla* and forms an important fishery in the Indus River, and the Bay of Bengal, whence it ascends into all the principal rivers of India and Burma. I shall, however, restrict myself this evening to its wanderings in Bengal waters.

¹ Lecture delivered at the Royal Asiatic Society of Bengal on Tuesday, the 25th March 1941.

The migratory habit of the species is of the greatest value from the point of view of its fishery, for it enables us to consume this marine fish in a fresh condition very far inland; it has been caught in the Ganges System as high up as Agra and Delhi.

The life-history of this most valuable fish of the Bengal waters has until quite recently been little known, but the researches carried out by the Zoological Survey of India since 1936 have materially helped to elucidate the nature and causes of its wanderings. With a fish of such handsome appearance and delicious taste one does not need to be a zoologist to be interested in its bionomics and life-history, and it is for this reason that I have selected "Life-History and Wanderings of *Hilsa* in Bengal Waters" as the subject of my talk this evening.



Text-fig. 1.—Lateral view of *Hilsa ilisha* (Hamilton). After Day.

The lateral markings on the body indicate that the figure was made from a half-grown specimen. In the young, these markings are very prominent, while in the adult they are generally absent.

At the very outset I wish to emphasize that a thorough knowledge of the bionomics, breeding, development, rate of growth, period of maturity, etc. of any fish of economic importance is a necessary requisite for the proper exploitation, development and conservation of its fishery in all its aspects. How backward we are in this respect will be clear from Kemp's statement made in 1938 before the British Association to the effect that "throughout almost the whole of the vast stretch of the Indo-Pacific region there is scarcely a fish whose life-history is fully known and whose various stages from egg to adult can be recognized."

Those interested in the fisheries of Bengal are no doubt aware of the fact that in 1906, the Government of Bengal placed the late Sir K. G. Gupta on special duty to enquire into Bengal fisheries. He went into the whole question very fully and after a complete and thorough survey of the fishery resources of the province made a number of valuable recommendations in 1908. With regard to *Hilsa* he stated:

Importance of Life-history Studies.

"Very strenuous efforts must also be made to observe the reproductive functions of the *hilsa* and ascertain their spawning grounds, so that when their anadromous character has been established, hatching stations may be opened to introduce artificial propagation for replenishing our rivers."

In his general account of the species he stated:

"the fishermen of Bengal believe that the *hilsa* does not spawn in the rivers, in proof of which it is asserted that no fry or young ones have ever been caught or seen."

In view of these weighty recommendations, the Government sent a special officer to America for studying Shad-culture. During 1909 and 1910, after his return from America, the Shad-culture specialist collected some general information relating to *Hilsa* from which he was led to conclude that spawning grounds of the species existed in the vicinity of Monghyr, Bihar. Jenkins found a single young specimen of *Hilsa*, 6 cm. long, from the market at Monghyr towards the end of September 1909 which seemed to confirm the above conclusion. Accordingly experiments were started on the artificial fertilization and hatching of eggs during several subsequent seasons but all efforts failed. Though the eggs have been fertilized and hatched, it has not been possible to rear the larvae to a fingerling stage when they could be safely planted in rivers. In 1914, in the course of his remarks on fishery questions in Bengal, Southwell surmised that:

"The eggs of this species sink rather low in the water. Their development roughly occupies nine days. The spawning grounds are seldom, if ever, more than 600 miles from the sea. They are frequently carried along by the river current at a rate of 90 miles per day. Hence the eggs often reach the sea, or the lower part of the estuaries before they are hatched, and the development of the fry takes place there. The eggs of *hilsa* are thus not only removed from destruction by human agencies, but on account of the fact that they sink in the water, they are never carried into the paddy fields during the flood. It is undoubted I think that the maintained plentifulness of the *hilsa* year by year is due entirely to the above facts. In this case legislation appears wholly unnecessary. The eggs and fry require no protection, and any interference with the fishing of adult *hilsa* is, I think, at present undesirable."

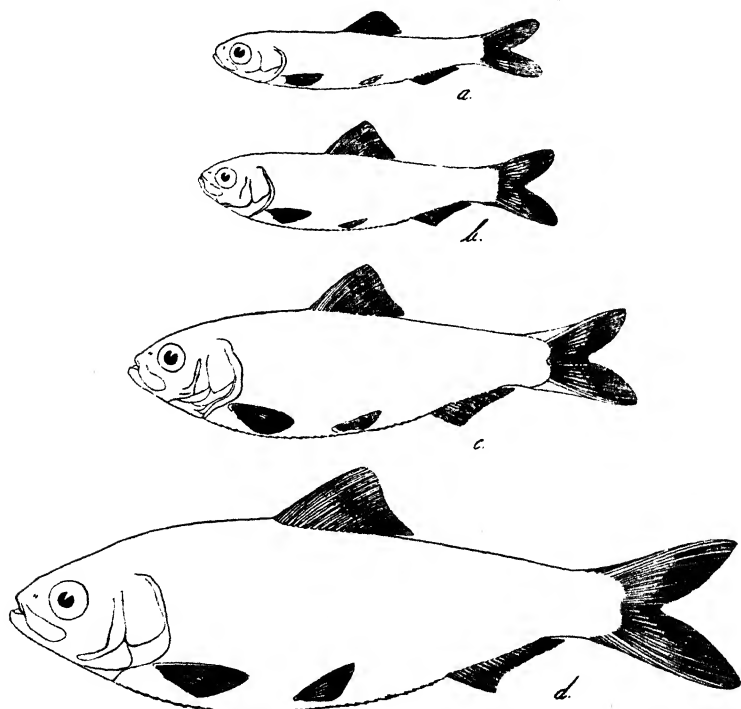
I shall show presently that the life-history of *Hilsa* is different from what was envisaged by Southwell. His timetable of the liberation and the seaward migration of the eggs of *Hilsa* is presumably based on the popular belief that the young are not found in the upper reaches of the rivers. In their general review of *Hilsa* investigations, Southwell and Prashad in 1916 recorded failure in the artificial propagation of the species and stated:

"So far as *Hilsa* are concerned, successful operation in artificial propagation depend almost entirely on our understanding clearly and fully the general habits of the fish in question. The elucidation of these problems is a matter of time, for the secrets of nature are seldom unfolded to the superficial observers."

In 1919, Prashad reported on the occurrence of *Hilsa* in the rivers of Bengal and in the Gangetic Delta throughout the year and thus cast doubts on the true anadromous nature of the fish. Next year Finlow referred to the enquiries conducted regarding the young *Hilsa* or *Jatka* and the winter *Hilsa*.

The position of *Hilsa* investigations in Bengal was thus summed up by Finlow in 1933 in his note on the scheme for the reorganisation of a Fishery Department in Bengal:

"So far attempts to locate the spawning grounds of *hilsa* have failed, and attempts at artificial fertilization have also been unsuccessful. On the other hand, the fingerling of the *hilsa* has been identified in the *Jatka*, a small fish less than 6" long, found in the Buriganga, Lakhya and Meghna rivers in Eastern Bengal in February-March. It is probable therefore that the main spawning grounds of the *hilsa* are in Eastern Bengal, and investigation to this end, particularly in the Lakhya, Buriganga, Torag and Meghna rivers, should form a definite item of the work of the Fishery Department.



Text-fig. 2.—Young of *Hilsa ilisha* (Hamilton) collected from the filter-beds of the Calcutta Corporation Waterworks, Pulta.

a. 19 mm.; b. 30 mm.; c. 42 mm.; d. 61 mm.

It must be remembered that with the abolition of the Fisheries Department of Bengal in 1923, the *Hilsa* investigation had also come to an end, so there was no current interest in the

Discovery of the
Spawning
grounds of *Hilsa*.

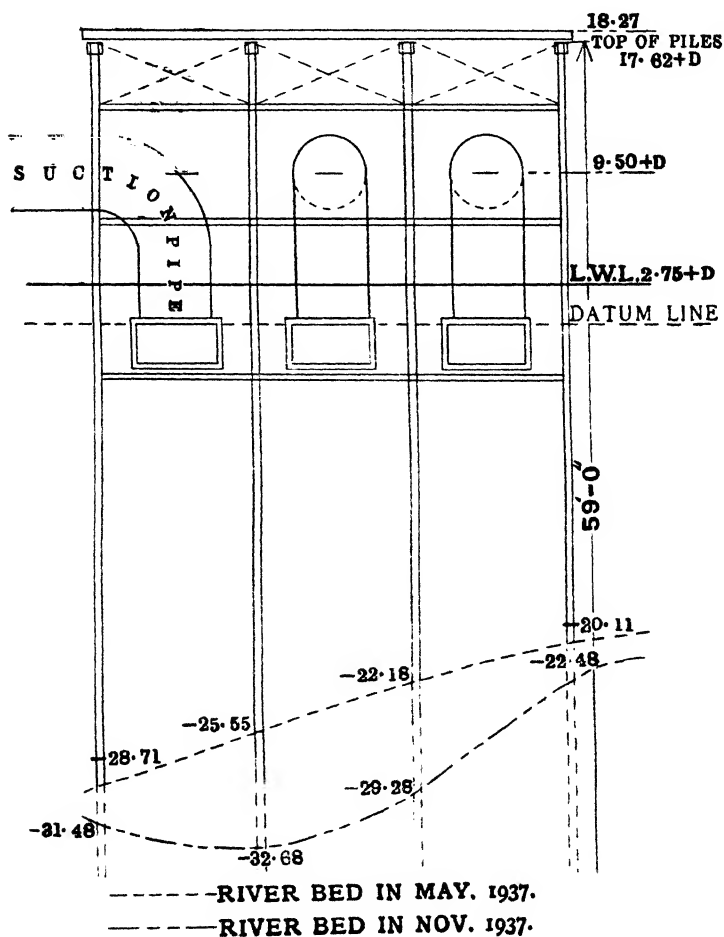
problem when, in 1936, by a mere chance I was fortunate to locate the spawning grounds of the species in the river Hooghly in the neighbourhood of the Pulta Waterworks. In 1936, the Corporation of Calcutta requisitioned the services of the Zoological Survey of India to investigate the biology of the filter-beds. In the course of these investigations collections were made of the fauna and a great variety of fish was obtained. Among these were large numbers of young Herring-like forms to which no attention was paid in our preliminary determination of fishes. Fortunately, about this time the Geological Survey of India entrusted to me for study and report a small collection of fossil fish-remains from the Saline Series of the Salt Range, Punjab, among which were several incomplete specimens of small Clupeid fishes. In order to compare them with the present-day forms, the young specimens from Pulta were examined and to my very great surprise some of them appeared to be the young of *Hilsa*. Not being satisfied with my own results, I gave similar specimens to my assistants and students at the Museum and they also found them to be the young of *Hilsa*. Once the discovery was made, we applied ourselves with the meagre resources available to us in the Zoological Survey of India for fishery investigations to unravel the mystery of the life-history and wanderings of this important food-fish of the province, and it gives me pleasure to say that we have already achieved considerable success in elucidating this problem.

Here I must pause and explain the full significance of the occurrence of the young *Hilsa* in the filter-beds of the Waterworks, and have, therefore, to claim your indulgence for a short digression.

***Hilsa* Investigations at Pulta Waterworks and in Hooghly River.** At the Pulta Waterworks (Plate 5) about 90 million gallons of river water is pumped daily into the settling tanks through 5 pipes—one 36" pipe, one 48" pipe and three 54" pipes. All the pipes are, however, not in commission at the same time. The mouths of the pipes (Text-fig. 3) are directed downwards. The three larger pipes are protected by an iron grating with bars one inch apart, while the other two pipes are provided with valve-like structures which prevent any large object from entering the pipes. It is thus seen that though large objects cannot be sucked into these pipes, fishes a few inches in length and less than one inch in thickness can enter the pipes. In the actual centrifugal pumps (Text-fig. 4), however, there is only a quarter inch space between the impellers and their covers so that larger objects are invariably crushed and only eggs or very young larvae can pass through intact to the settling tanks. This was tested by making several collections of the fauna from the river water soon after it had passed through the pumps; in all samples only very minute objects were obtained. This means that *Hilsa* enters the Waterworks from the river either in the egg stage or as very young larvae. Fortunately one of the *Pucca* Settling

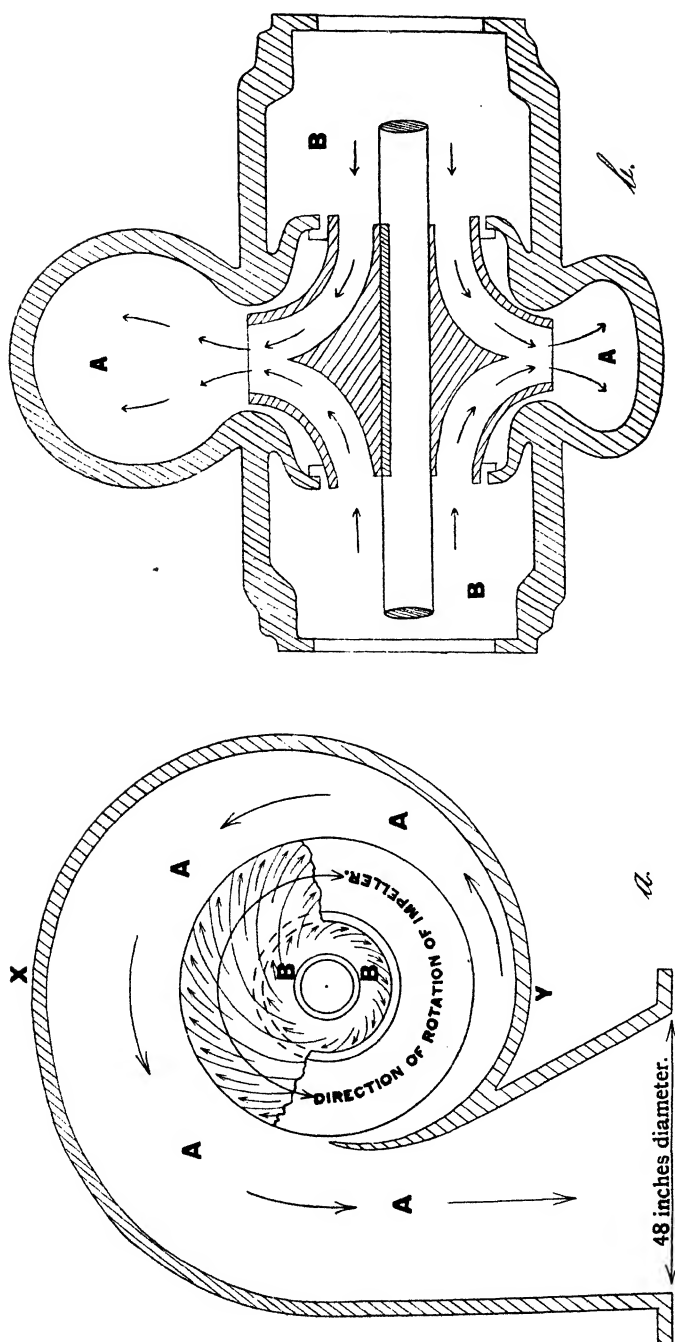
Tanks at Pulta is an isolated one so that it can be easily charged or emptied without any interference with the working of the other units. This tank, 500 ft. long, 250 ft. broad and on an

H. W. L. 23.00



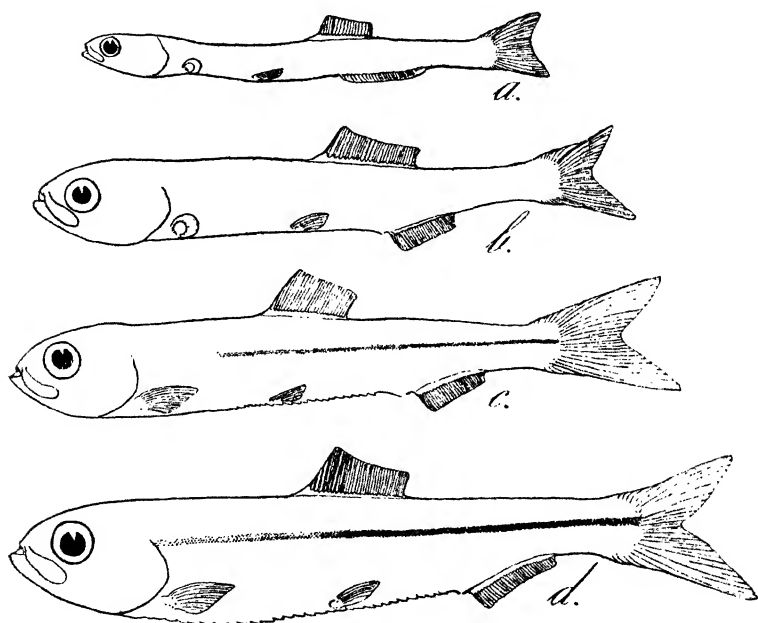
Text-fig. 3.—Section of new jetty for 54" pipes, Calcutta Corporation Waterworks, Pulta. (Copied from *Rec. Ind. Mus.*, XL, p. 151, 1938.)

average about 8 feet deep, is occasionally charged with river water, but when the water in it becomes sufficiently settled, the upper half or more of the water depending upon its suitability is



Text-fig. 4.—Diagrammatic sections of a Centrifugal Pump, Intake-Station, Calcutta Corporation Waterworks, Pulta.
a. Side view of section of the pump; *b.* View of a section through *xy* of *a*; A. Suction space; B. Pressure space.
 An arrow indicates the direction of flow.

drawn off to the filter beds, and the tank is filled up again with river water. This process is repeated from 2 to 8 times in a month depending upon the weather conditions and the amount of suspended matter in the river water at different seasons. The Pucca Settling Tanks are thoroughly cleaned once a year and during one such operation on the 21st November, 1937, 900 young *Hilsa* from Tank No. 4 were measured (*vide* Table I, p. 110). From the different sizes represented in this lot, the probable rate of growth of the species was surmised. Further, taking advantage of the fact that only eggs or larval fish can pass through the centrifugal pumps to the settling tanks, the tank was almost completely dewatered once a month so that the young of the various species of fish developed from eggs or larval forms received from the river during the month were collected. It



Text-fig. 5.—Larval forms of *Hilsa ilisha* (Hamilton) collected from the Pucca Settling Tank No. 4, Calcutta Corporation Waterworks, Pulta. $\times 4\frac{1}{2}$. After Nair. (Copied from *Rec. Ind. Mus.*, XLI, p. 411, 1939.).
a. 14 mm.; b. 18 mm.; c. 20 mm.; d. 22 mm.

Mr. K. K. Nair's figures of the larval forms of *Hilsa* show varying number of rays in the dorsal and anal fins, but he has informed me that the figures in this respect are diagrammatic and, therefore, no significance need be attached to this point in considering their identity.

was, however, too costly to dewater the tank completely and to clean it up properly every month, so some young forms received

in the tank during earlier months usually got mixed up with the stock that came in later, but they could be readily eliminated on account of their larger size. The material thus collected for one year (first collection was made on December 28, 1937), has furnished valuable data regarding the season of breeding and the probable rate of growth of a number of species found in the river Hooghly. So far as *Hilsa* is concerned, these observations have conclusively shown that *Hilsa* breeds in the Hooghly throughout the year though the peak period of breeding is during the rainy months of July and August. Observations on the month to month growth of the species have shown that specimens 10 months or a year old are just about a foot in length, and that the fish attains a marketable size in a few months' time. The rate of growth is more rapid during the hot months, and it has been found that during July-August the young of *Hilsa* attain a size of about 2 inches in the first month and thereafter the size increases at the rate of about an inch per month with the exception of the winter months when the growth is somewhat retarded. It may here be stated that similar results had also been obtained by the Madras Fisheries Department regarding the growth of the species in certain South Indian rivers.

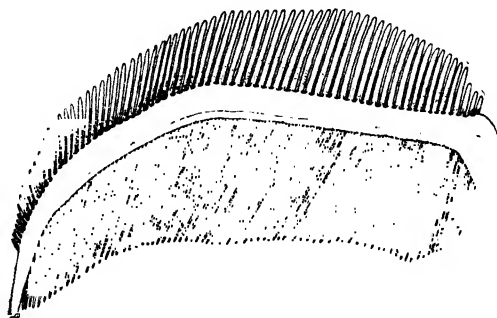
In the *Pucca* Settling Tanks, facilities for the movements of bottom or mid-water fishes, like the *Hilsa*, are restricted and the thorough cleaning of the tanks every year does not permit of such species to grow beyond one year. In another series of five large *Kachha* Settling Tanks, however, the fish can move about freely and some of them can live up to their maximum age. Specimens of 18 inches and over have been obtained from these tanks and some of them were fully mature as the milt and eggs streamed out when they were caught. Whether *Hilsa* is capable of breeding in confined waters or not, we have not been able to ascertain. It is certain, however, that the fish is not unsuitable for tank culture, although it must be stated that in freshwater tanks the fish loses much of its flavour and taste¹. However, experiments may be started in the brackish water areas of the Sunderbans for the culture of this species, for, as I shall presently show, the young of *Hilsa* are plentiful in those waters and no expensive hatcheries are needed for this purpose.

Another important advance in our knowledge of the life-history of *Hilsa* was made near Pulta. From the collection of river fishes made at Nawabgunge at different seasons some light was thrown on the movements of the young *Hilsa* in the river

¹ Those who have had occasion to taste the flesh of *Hilsa* from the rivers of Bengal and also from those of Bihar and the U.P. have told me that the up-country *Hilsa* is a very poor fish. On account of the large number of small bones it rarely finds favour with the better class of people in the U.P.

Hooghly. We found that large quantities of very young *Hilsa*, some as small as 35 to a tola in weight, are caught in the Hooghly during November to February; the size of the specimens obtained at Nawabgunge, however, increased month after month (*vide* Table II, p. 111) showing thereby that the progeny of the individuals that spawned higher up was passing down to the sea.

At Pulta we also investigated the food of the species from the young to the adult stage and found it feeding on planktonic



Text-fig. 6.—Lower half of first left gill-arch of a young specimen of *Hilsa ilisha* (Hamilton). $\times 2\frac{1}{2}$. (Copied from *Rec. Ind. Mus.*, XL, p. 155, 1938).

The actual number of gill-rakers on this portion of the gill-arch was 156, but 95 could be shown in the drawing.

organisms. A study of its branchial arches showed that they are definitely adapted for straining microscopic life; its gill-rakers are setose, long, slender and close-set, and act like a sieve.

Having obtained some information regarding the life-history of *Hilsa* from our studies at Pulta and at Nawabgunge on the river Hooghly, we extended our observations to other rivers of Bengal and those of the neighbouring provinces. Our first attempt was to elucidate the fishery of the *Jatka* fish of Eastern Bengal to which Finlow had referred in his reports mentioned above. In February 1939, Mr. M. N. Datta of the Zoological Survey of India visited Barisal, Patuakhali, Galachipa, Chandpur, Narayangunge and Goalundo, but he was not able to collect any definite information regarding *Jatka*. However, among the specimens collected by him at various places we found young *Hilsa* (*vide* Table III, p. 111) from 1 to 5 inches in length which clearly showed that, as in the River Hooghly, the fish breeds in the rivers of Eastern Bengal throughout the year. Mr. Datta found extensive fishing for young *Hilsa*, 7 to 11 inches in length, at Goalundo, Narayangunge and Chandpur. In 1940, through the kind interest of the District

authorities, several consignments of *Jatka* were received from Lakshmipur, Narayangunge and Dacca. Our detailed studies on the taxonomy, size and food of these specimens have definitely established that *Jatka* represent the young of *Hilsa* 2 to 5 months old, that the migration of *Jatka* from the estuaries into fresh-waters is for feeding purposes, and that during the *Jatka*-phase, the fishery of which lasts from February to April, the *Hilsa* feeds and grows until April-May when the feeding stops and the growth is inhibited. It is remarkable that the *Jatka* disappears from the rivers as suddenly in April-May as it reappears in them in February-March. The significance of *Jatka* in the fishery of *Hilsa* will be discussed later.

Through the kindness of Professor D. R. Bhattacharya we have obtained young, half-grown, and adult specimens of *Hilsa* from Allahabad (*vide* Table IV, p. 111), and through the courtesy of Mr. Stanley Howard a very young specimen from a tributary of the Mahanadi River in the Patna State (*Statesman*, Calcutta, 18th October, 1940). The Madras Fisheries Department found the young of *Hilsa* in the rivers of Madras and made valuable observations on the rate of growth and life-history of the species. It has now been definitely established that the swarming of the mature *Hilsa* into the rivers during the flood season is mainly for spawning purposes, but a number of young individuals also ascend and these travel far inland before they become sexually mature. Thus we get *Hilsa* breeding throughout its range both in the tidal waters and in the middle reaches of the large rivers. Though a number of specimens of *Hilsa* can always be found in the rivers, the floods and the sexual maturity of the migrants seem to induce the swarming *Hilsa* in the sea to undertake the upward journey into the rivers.

Having located the spawning grounds of *Hilsa* and its mode **Marine Life** of life in rivers, our next attempt was to *Hilsa*. get some idea of its wanderings in the sea. Here again fortune favoured the Zoological Survey of India. In February-March 1939, a party of the Department in the course of its investigations on the fauna of the Balasore Coast at Chandipore found extensive catches of *Hilsa* from the sea in *Ber* fishery. Later it was found that O'Malley in the Gazetteer for Balasore District had already recorded that extensive *Hilsa* fishing is carried out in the sea along the coast. He observed:

"The fishermen are particularly keen in their pursuit of the *hilsa*, and a flotilla of sea-going craft will sometimes drift along together for days, awaiting the approach of a shoal of that fish. When the shoal arrives, they at once fill their boats, steer straight for shore, and convert their haul into *sukhua* or sun-dried fragments of fish—a favourite relish with the Oriyas."

These observations led us to consult all earlier works on *Hilsa* very carefully and we were rewarded by finding several

references to *Hilsa* in the sea. Further, it became clear that along the coasts of Bengal and Orissa and in the estuaries young *Hilsa* about 7 to 10 inches in length were fished extensively during the cold months. We arranged to get samples of *Hilsa* from Chandipore every month from which our tentative conclusions are that *Hilsa* in all stages of growth are found in the sea all along the foreshore in the shallow waters of the Bay of Bengal, that most of the specimens caught in November are less than one year old, and that the fish feeds and continues to grow in the sea except during November and February and possibly during May-June also.

The earlier records of the occurrence of *Hilsa* in the sea and the results of the enquiries made by us from the officers in charge of the Pilot Vessels stationed not very far from the mouth of the river Hooghly (Plate 6) leave no doubt that after leaving the rivers the fish do not go far into the sea but move about in shoals in the estuaries and the foreshore. The fish lives in shallow waters and has not yet been recorded from waters more than a few fathoms deep.

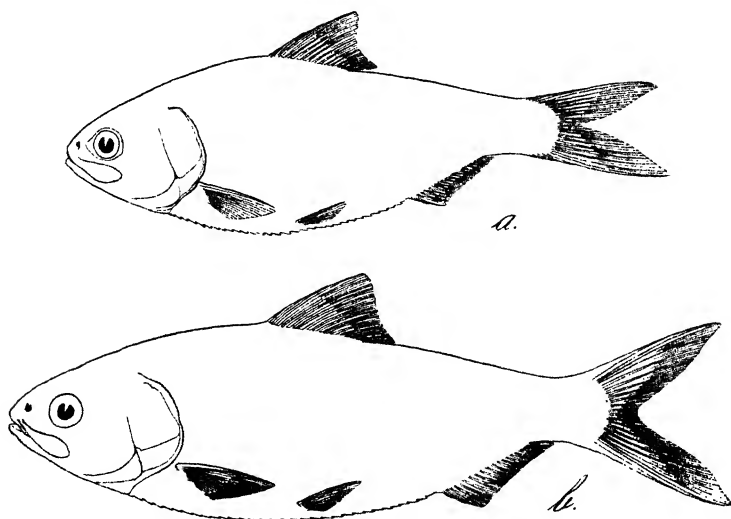
Though our observations are yet inadequate and inconclusive for any fishery forecasts, we can confidently claim that an advance has been made in our knowledge of the life-history and wanderings of *Hilsa*. For instance, we definitely know that the spawning grounds of *Hilsa* are in our rivers and that the young of one to three inches in length are caught in the rivers in basketfuls during the months of November to February to be sold at the rate of 6 pice per seer. Again during the cold weather, shoals of this fish about 7 to 9 inches long are caught in the estuaries and along the foreshore. In February-March there is an extensive fishery of *Jatka* in the rivers of East Bengal, and then during the monsoon floods mature fish swarm up the rivers and yield us our most valuable *Hilsa* fishery. In the circumstances detailed above it is a wonder why the fish has not been totally exterminated so far, for we have devised extensive fisheries of the species in all stages of its growth and in all places where it wanders from season to season. I shall now attempt to discuss the causes that have saved this species from total destruction.

In the olden days, the Hindus of Bengal did not eat *Hilsa* from the last day of the Durga Puja, **Close Period for** usually at the end of September or at ***Hilsa* Fishery.** the beginning of October, to the Sri-panchmi day, at the end of January or the beginning of February, or in other words a close season of about three and a half months was observed. This is the period when the main swarms of *Hilsa*, after spawning in the rivers, go back to the sea to recuperate and fatten for the next spawning season and their young move down to the sea in large numbers. During these phases the fish is of poor quality and hardly worth eating. But owing to the

pressure of increasing population on the food resources of the country and to the so-called advanced modern education, the people now ignore this injunction as a piece of superstition. In all important fisheries, a close season is observed all over the world and there is no reason why the old practice that has probably helped to preserve the fishery to a certain extent, may not be revived. Though during the season all possible means are adopted by the fishermen to entrap swarms of *Hilsa*, many still escape to propagate the race. Even one adult pair, under suitable conditions, can produce tens of thousands of young ones. As the eggs sink to the bottom and the fry start their seaward journey soon after hatching they escape destruction and reach the sea when the rivers are still in floods. Thus natural protection is afforded to the fry during rains. As pointed out already, *Hilsa* fry are caught in the rivers when the waters fall low in November-December and it becomes possible to use fine-meshed nets at the bottom. During nor westers also the young of *Hilsa* are left alone because the weather conditions are not favourable for using fixed bottom nets. Nature has thus made some provision for the protection of the young, but how far the greed of man will allow it to remain effective, it is difficult to say. In the light of the above remarks, it is imperative, however, to consider the question of devising protective measures for the conservation and proper exploitation of this important fishery.

In his recommendations, the late Sir K. G. Gupta thought of this eventuality and suggested that *Hilsa* hatcheries not required. hatching stations may be opened for the artificial propagation of the species with a view to replenish the depleted rivers of Bengal. In this connection it must be remembered that, besides the question of heavy cost, the greatest output of a series of hatcheries would be but a trivial fraction of the output from a relatively small number of natural spawners. So true is this that in many advanced countries, in trying to maintain salmon in streams, the authorities have stopped hatchery work and are concentrating on helping the spawning fish to get on to the natural spawning beds. From what I have seen and learnt of the *Hilsa* fishery, I am definitely of the opinion that even now there are plenty of fry, but the great problem is to devise a way to protect the young *Hilsa* so that a due proportion may reach maturity and spawn. I have shown that at present very young *Hilsa* of about 1 to 3 inches in length are caught in basket-loads during November to February, young of about 6 inches in length, known as *Jatka*, are caught in millions in the rivers of Eastern Bengal during February-March-April and throughout the cold season young fish of 7 to 9 inches are caught in boat-loads in the estuaries and along the foreshore. The fishery of young *Hilsa* at all these

stages leads to the depletion of the natural stock. With the increasing demand for fish, there will be a corresponding activity in catching fish of all sizes. However, in legislating for regulating the relatively unproductive fishery of the young, some alternate mode of subsistence will have to be found for the fishermen, otherwise, it may mean great hardship to those poor people. In view of the abundance of young *Hilsa* in Bengal waters, there is hardly any necessity for establishing *Hilsa* hatcheries. All the same the question of the *Hilsa* fishery in Bengal is of such vital importance that it requires very thorough investigation before any remedial measures can be suggested. For instance, in reviewing our *Hilsa* investigations, European and American Likelihood of experts have surmised, on the analogy several Races of of Herring-fisheries in European waters, *Hilsa*. that there may be different races of *Hilsa* which breed under different environmental conditions. Our



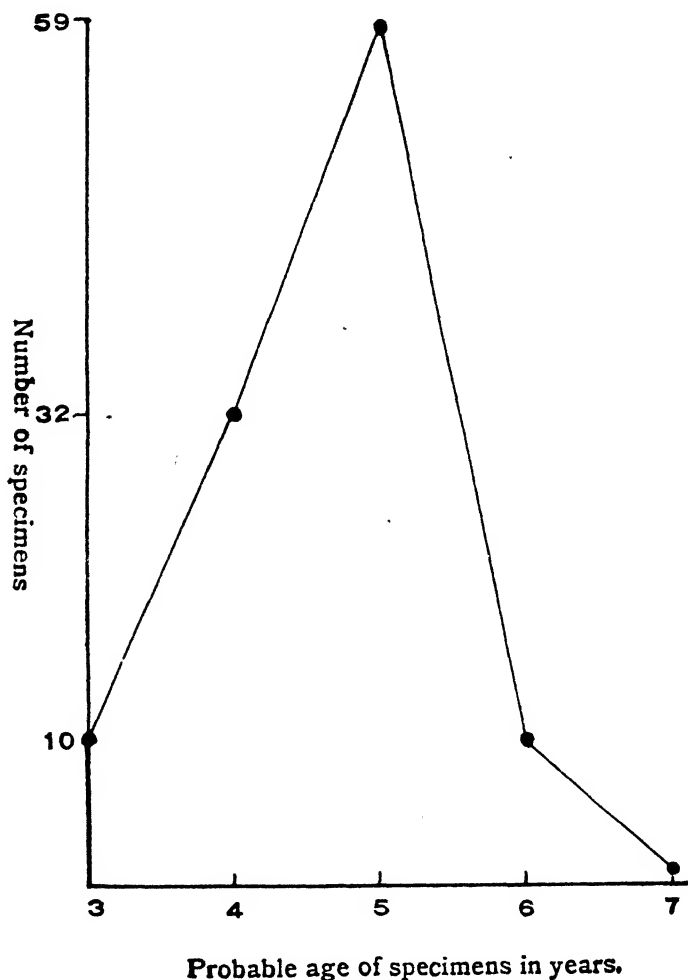
Text-fig. 7.—Two forms of *Hilsa ilisha* (Hamilton) as judged by the depth of the body and the form and size of the head.

a. East Bengal form. Length 124 mm.; b. Hooghly river form from Pulda. Length 150 mm.

investigations also indicate the possibility of our having several races or varieties of *Hilsa* in Indian waters, and though we are making every possible effort to elucidate this point, with the limited means at our disposal, it will take considerable time to get together the necessary material and to make the requisite biological observations. The *Hilsa* fishery is really a very vast problem.

Sir K. G. Gupta, in the course of his enquiries, received complaints from all directions that the supply of *Hilsa* was on the decline. But all of us are aware that *Hilsa* was most abundant in 1934, the year of the Bihar

Fluctuations in
Hilsa Fishery.
Five-year Cycle.



Text-fig. 8.—Graphic representation of the probable age of 112 specimens of *Hilsa ilisha* (Hamilton) imported into Calcutta from Goalundo during June-July, 1939. (Copied from *Rec. Ind. Mus.*, XLII, p. 48, 1940).

earthquake, and in 1939. It has been suggested that there is a five year cycle in the fishery of this species. From the authorities

of the A. B. Railway at Chandpur, I have been able to obtain valuable data (*vide* Table V, p. 112) regarding the booking of *Hilsa* fish to principal stations on the A. B. Railway for the years 1937, 1938, 1939 and 1940. I was also informed that the season for *Hilsa* generally starts from April and continues up to October. The figures in the table show great annual fluctuation in the fishery and also fluctuations from month to month. If future observations bear out our assumption regarding the five-year cycle in the fishery of *Hilsa*, it will be the duty of persons interested in the welfare of the masses to see that the catches of the fishermen during such periods are properly preserved so that they can be utilized during the lean years of the fishery. In 1939, the *Hilsa* fish was so plentiful in Bengal that tons of fish were allowed to go waste in Eastern Bengal, for there was no one to purchase them. If proper arrangements¹ had been made in the form of having a floating cannery, which could be moved from place to place, the problem of finding a considerable quantity of canned fish or fish oil would not trouble anybody now.

In Europe and America, it has now been ascertained definitely that "Annual fluctuations in the abundance of a fish may be very great. One year may be exceptionally favourable, with production far above normal, to be followed perhaps by several years of scarcity; and it is not uncommon to find that fish belonging to one year class are fifty times as numerous as those of another. These great fluctuations, which are the foundation on which fishery prediction is based, are for the most part to be attributed to events which happened in the early months of the fish's life; and when we consider the manifold perils, meteorological, physico-chemical and biological, to which the eggs and larvae of a marine animal are subject, it is little wonder that there may be such great differences from one year to another, nor is it a matter for surprise that the precise reasons for good and bad spawning seasons are as yet unknown." (S. W. Kemp, Presidential Address. Zoology Section. Brit. Ass. Adv. Sci. 1938). In the case of *Hilsa*, though considerable advance has been made in our knowledge of its bionomics and life-history,

Scientific Exploitation of the Fishery urged.

a great deal still remains to be done by a band of expert scientists to put its fishery on a scientific basis. It is for the elucidation of these and similar other problems that the establishment of a well-equipped and suitably staffed fishery department in this province is absolutely essential. The economic value of *Hilsa* to this province is so great that its fishery alone may form the subject for investigation by a commission.

¹ Fisheries in India suffer mostly for two reasons—lack of transport facilities and the primitive methods adopted by fishermen in preserving their catches. Fortunately we have still extensive fisheries which can yield valuable food supply, if properly exploited.

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TABLE I.

Table of Measurements of 900 Young Hilsa collected from the Pucca Settling Tank No. 4 on 21st November 1937, arranged in 10 mm. Difference groups.

Number of specimens.	Measurements in millimetres.		
1	57
7	80–89
72	90–99
56	100–109
52	110–119
32	120–129
97	130–139
273	140–149
220	150–159
74	160–169
14	170–179
2	180–189

TABLE II.

Length in mm. of young Hilsa collected at Nawabgunge.

Date of collection of samples.	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
30th October, 1938 ..	204	153	3	..	..	..	..	..
13th to 15th November, 1938 ..	5	42	78	4	2	..	..	..
27th February and 1st March, 1939	..	..	8	45	22	3	3	1

TABLE III.

Young Hilsa from East Bengal collected in February 1939.

Length in millimetres.	Number of specimens collected at			
	Gazalia (River).	Galachipa (River).	Patua-khali (Market).	Narayan-gunge (Market).
30-39 ..	..	..	3	..
40-49 ..	..	..	20	..
50-59 ..	..	1	30	..
60-69 ..	..	..	29	6
70-79 ..	..	..	33	3
80-89 ..	1	..	6	2
90-99 ..	..	1	2	..
100-109 ..	4	3	4	..
110-119 ..	10	7	18	..
120-129 ..	2	11	17	..
130-139 ..	1	2	4	..

TABLE IV.

Young Hilsa collected at Allahabad by Professor D. R. Bhattacharya on or about the 20th June, 1940.

Standard length in millimetres.	Number of specimens.
53 ..	1
58 ..	1
59 ..	1
60 ..	1
61 ..	1
62 ..	2
64 ..	3
65 ..	1
66 ..	1
69 ..	1
74 ..	1

TABLE V.

Figures in maunds of Hilsa exported from Chandpur from April to October during 1937, 1938, 1939 and 1940.

Name of month			1937.	1938.	1939.	1940.
April	..	..	954	198	1,359	1,288
May	..	..	1,364	265	2,517	1,331
June	..	..	3,300	879	8,544	4,401
July	..	..	2,697	1,709	5,268	4,137
August	..	..	985	1,380	2,003	1,630
September	..	..	1,708	1,936	3,675	5,117
October	..	..	1,232	1,633	2,786	4,230
TOTAL			12,240	8,000	26,152	22,134

EXPLANATION OF PLATES.

Plate 5.

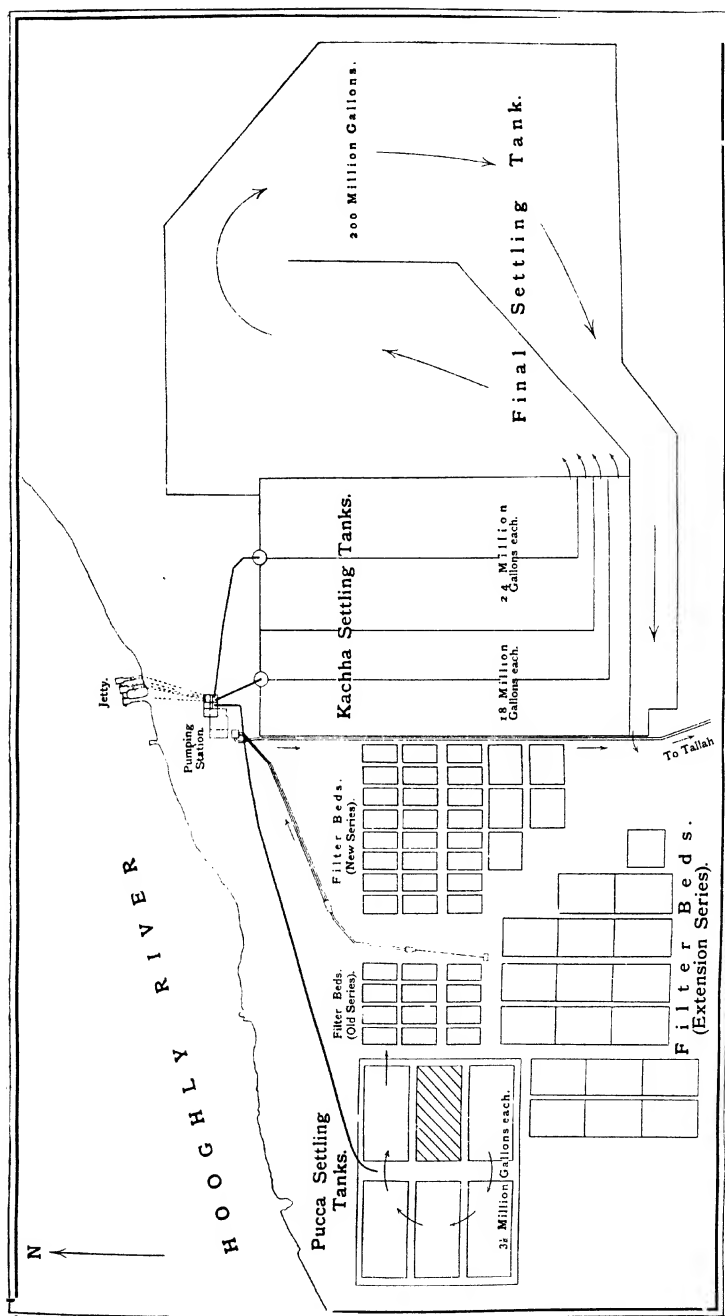
Site plan of Calcutta Corporation Waterworks, Pulta.

Plate 6.

A map of Sandheads and the Balasore Coast. The five, ten and twenty fathom depth zones are indicated by different types of hatched lines. (Copied from *Rec. Ind. Mus.* XLII, pl. ix, 1940).

From the abundance of *Hilsa* shoals in the shallow flats close to the river mouths and their neighbourhood on the Bengal and Balasore Coasts and their probable absence from the area round Pilots Ridge it is surmised that this species in its seaward migration does not go far out into the sea.





SITE PLAN OF PULTA WATER WORKS.

A Psychological Study of Arithmetical Ability with Reference to the Students of Secondary Schools.

By N. C. CHATTERJEE.

(Communicated by Dr. G. Bose.)

INTRODUCTION.

This is a report of an investigation in the field of arithmetical abilities of the students of Secondary Schools. The work extended over a period of two years, 1939 and 1940, and samples of High School students in Bihar and Bengal were tested in arithmetic under my close personal supervision.

The idea was to effect, by statistical analysis—

- (a) a standardized objective test in 'reasoning' arithmetic on grade-norm basis, suitable for the students of Secondary Schools,
- (b) a psychological analysis of the students' responses to the questions of the test and their educational implications, and
- (c) a comparative study of the arithmetical abilities of students in Bihar and Bengal.

The first of the aforesaid topics was already published in a non-technical form and was, in a way, supplementary to and a continuation of a similar work undertaken by me some time back, which resulted in a standardized objective test in 'mechanical' arithmetic for the High School students on grade-norm basis and which was published in the Indian Journal of Education, September, 1939.

For the purpose of the present investigation I have drawn my inspiration and guidance from works of Prof. Thorndike, Dr. Ballard, C. W. Stone, S. A. Courtis, Prof. W. S. Monroe and various interesting contributions concerning the nature of arithmetical ability that have appeared from time to time in the British Journal of Educational Psychology. To this list I should add, most humbly, my own experience as a teacher concerned with school mathematics of no less than 22 years' standing.

Standardization of the Test.

Arithmetic, as is generally taught in schools has two parts, namely, the 'tool' and 'problem' parts. The former deals with such topics as the four simple and compound rules, reduction, practice, fraction, decimals, square-root, L.C.M., G.C.M., average, etc., that require only mechanical working out

of sums, while the latter deals with all sorts of arithmetical problems demanding the exercise of reasoning. This, by no means, however, implies that the two parts are mutually exclusive.

When a child works out a problem sum, his mental process involves, in the first place, his powers of comprehension, analysis, synthesis, assimilation, judgment, etc., all of which may be put under the term, reasoning, as is popularly conceived. In the second place, this conscious process of reasoning brings into play a train of habit-bonds, more or less automatic, which the children must have built up earlier in course of their drilling in tool arithmetic. Thus, arithmetical ability that functions through problem sums involves children's power of reasoning as well as their skill in mechanical computation.

My present investigation being a study of arithmetical abilities through problem sums, I made, at the outset, a tentative selection of about a hundred such sums from all topics of arithmetic that are taught to the four top classes of a High School. Utmost care was taken to see that the problems were as easy as possible. Six graduates were then engaged, one at a time, in working out these sums at their normal speed, and in every case the time taken for each sum was carefully reckoned in seconds by means of a stop-watch. The average number of seconds thus required for each sum was next calculated and those sums that took comparatively less time than others and also were found fairly representative of the whole 'problem' part of arithmetic were retained and the rest discarded. Thus were left thirty problem sums as listed below:—

ARITHMETICAL REASONING.

1. Two-thirds of a class consist of 20 boys. How many boys are there in the class?
2. Find the cost of 12 chairs at Rs.5-8 per pair.
3. A carpet 20 ft. by 15 ft. cost £10. What was the cost per square yard?
4. Ram is as old as Mohan; Mohan is twice as old as Rahim; Rahim is as old as Hari. If Hari is 5 years old, how old is Ram?
5. I want equal numbers of stamp and post card for Rs.1-5. If a stamp cost one anna and a post card 9 pies, what will be the number of each?
6. How many men can do a piece of work in 12 hours which 4 men can do in 18 hours.?
7. A man takes 20 minutes to walk from his house to the station. His son also takes 20 minutes. How long will it take them if they both walk together?
8. What is the greatest number that will divide 64 and 76, and leave a remainder 4 in each case?
9. The area of the floor of a room is 196 square feet. What is the sum of its four sides?
10. If mango sells at the rate of Rs.3-2 per 100, how many can I buy for 7as.?
11. The distance round the wheel of a motor-car is 3 ft. 6 in. How many times does the wheel go round in travelling 140 yd.?

12. Find two numbers whose sum is 19 and whose difference is 5.
13. The area of a field twice as long as it is broad is 200 sq. yd. Find its sides.
14. How many times can I subtract 3 from 73?
15. What is the length of a stick which I can cut up into 8 pieces, each 6 in. long and have 4 in. left over?
16. A man aged 35 years is 7 times as old as his son; how many times as old as his son will he be 25 years hence?
17. At what rate per cent, simple interest, would Rs.10 amount to Rs.11 in 4 years?
18. Rs.9-11 is made up of equal numbers of Rupees, eight-anna, four-anna, two-anna and one-anna coins. Find the number of each.
19. I buy some articles for Rs.40; what must I sell them for, so as to gain 20%?
20. If $\frac{3}{5}$ of a piece of cloth cost Rs.3-6, what is the cost of the whole piece?
21. After spending half of my money and then half of the remainder I had 2 annas left. How much had I at first?
22. Divide Rs.30 between A and B so that their shares may be proportional to 6 and 4.
23. What is the least number which must be subtracted from 45 to make it exactly divisible by 7?
24. What two whole numbers multiplied together make 11?
25. There are two numbers one of which is greater than the other by 4. When multiplied together they make 165. What is the smaller one?
26. If telegraph poles stand 50 yd. apart in a straight row, what is the distance from the first to the eighth?
27. 5% of A's income is the same as 15% of B's. A's income is Rs.300 a year. What is B's?
28. A brick weighs 7 lb. and half its own weight. What is the weight of the brick?
29. If a man's salary is Rs.80 a month and he spends Rs.56 a month, how long will it take him to save Rs.600?
30. If 2 pencils cost 5 pice, how many pencils can you buy for 50 pice?

The average time taken for doing each sum being not much, each was given 1 mark as its weight. This does not mean, however, as will be presently seen, that the difficulty values of these problems were the same for the school pupils for whom the test was standardized.

The test was now printed and administered to 73 graduates and 1,520 High School students at Patna during the months of September and October, 1939, under my personal supervision, and uniform conditions were observed throughout. Eight schools of different types were selected for the test in order that the samples might be fairly representative of the 'population'. Exactly half an hour was given to each group of subjects to answer the questions and in the case of Class VIII these were translated into Hindustani and Bengali, which were introduced as media of instructions from 1939, beginning with that class. The students were asked to work out the sums 'in their head' or on scrap papers if they so liked and were told to put down their answers at the end of the questions. Every step was taken to secure normal and independent responses of the subjects, who were strictly prevented from using any unfair means whatsoever.

The marking of the answers was now a simple affair. The questions whose answers were correct were tick-marked and counted, and then the totals were put down at the bottom of the question papers. The services of some pupil teachers of the Patna Training College were requisitioned at this stage of work. After the students' responses were thus measured, their 'point-scores' were dealt with statistically, class by class, with the result as shown by Table 1 below:—

TABLE 1 (*Patna*).

	Q_1	Median	Q_3	Mean	σ	Skewness
Graduates ..	19.6	23.6	26.3	22.3	5.4	— .72
Class XI ..	12.5	16.6	21	16.8	5.7	+ .10
Class X ..	9.5	13.7	17.1	13.6	5.5	— .05
Class IX .	7.3	10.3	14.8	11.2	5.1	+ .53
Class VIII ..	6.3	9.7	13.3	10	5.0	+ .18
Classes IX and VIII combined ..	6.8	10	14	10.54	5.1	+ .32

N.B.— Q_1 = First Quartile.

Q_3 = Third Quartile.

σ (sigma) = Standard Deviation.

Next year the test was translated and printed in Bengali and administered to 884 boys in three High Schools selected at random, in Calcutta, during the month of May. Exactly the same process was gone through in regard to the collection of data, measurement of scores, tabulation of figures, etc., as was done in the case of Patna students. The corresponding table is given on the next page.

The norms or pass standards for the test were now easily deduced from the above tables by making a compromise between the mean and the median for each class and by leaving out the decimals. Thus the norms are as follows:—

Patna classes ..	..	XI	X	IX	VIII
Calcutta classes ..	..	X	IX	VIII	VII
Norms ..	..	16	13	10	9

This means that a student of average merit should correctly answer 16 questions if he belongs to the topmost class, 13

TABLE 2 (*Calcutta*).

	Q_1	Median	Q_3	Mean	σ	Skewness
Class X ..	12	16.2	22.3	16.1	5.5	-.05
Class IX ..	9.3	13.1	17.3	13.5	5.3	+.22
Class VIII ..	6.3	9.2	12	9.6	4.3	+.28
Class VII ..	5.5	8.7	11.8	9.5	5.6	+.43
Classes VIII and VII com- bined ..	5.9	9	11.9	9.57	5.0	+.34

questions, if he belongs to the next lower class and so on, provided that all the conditions of the test including the time of the year are strictly observed. It may be noted here that a psychological test of achievement to be really scientific and effective should be standardized on the age-norm rather than on the grade-norm basis as the present test is. But as the information about the students' chronological ages required for the age-norm basis was not thought to be accurate enough for a strictly scientific enquiry I had to confine myself to the calculation of the grade-norms alone.

Before the test is considered as standardized for the Secondary Schools of both Bihar and Bengal we must show that it satisfies a number of statistical criteria. A good test is judged mainly from its validity, reliability, objectivity and ease of administration and scoring.

The two criteria, reliability and validity, refer to different aspects of what is essentially the same thing, namely, test efficiency. But the test efficiency is impossible of attainment unless the samples with which the test is standardized are representative or adequate in character. So, let us first see if our samples are really representative.

One of the simplest tests of the representativeness of a sample consists in drawing from the 'population' more than one groups of fairly large size. If the measures of central tendency, variability, etc., calculated from these groups are of nearly the same magnitude, we may be reasonably assured that our sample is representative. A glance at Tables 1 and 2 clearly indicates that (i) the quartile, median and mean measures of the arithmetical abilities of the two groups of students tend to be equal to one another, class by class, (ii) these measures, again, increase in the same manner from the lowest to the highest class, (iii) the

standard deviations from the mean tend to remain constant, and (iv) the skewness of the distributions is insignificant in the higher classes but is quite prominent in the lower.

When we scrutinize the figures in the first four columns of the tables more closely, we find that the measures for the Calcutta students fall slightly short of those for the Patna students in the higher forms and markedly short in the lower forms. The reasons for this general deviation will be quite clear when we remember that the test was applied to the Calcutta Schools four or five months earlier in the Session than in the case of Patna, and that only three schools were tested in Calcutta as against eight at Patna. I am sure that the difference would not have arisen had the conditions regarding the time of test and the number of schools remained the same at both the places. If, however, we allow to the Calcutta figures $\cdot 5$ to 1 marks for this emergency, the measures in question will be exactly the same in the higher classes and almost the same in the lower. Thus we see that the two groups of samples tell almost the same story and so we may safely say that they are representative of the 'population' from which they were drawn.

The validity of a test or other measuring instrument is determined *directly*, where possible, by finding the correlation between the test and some independent criterion. Such a criterion must be a highly objective measure in terms of which the value of the test is estimated. But the difficulty is that we are not able to secure independent measures of abilities that are recognized as highly accurate. We are, therefore, compelled to study the validity of most tests by methods which are *indirect*.

One of the indirect methods of validating a test is to rely upon the independent opinions of competent judges, and still another is to see if the statistical results agree with our expectations. Both these methods were employed to validate our present test.

The teachers in charge of mathematics in one of the schools at Patna, immediately after it was tested by us, were asked to supply me with twelve names of boys in each class ranked in order of merit such that four of them would be the best, four mediocre and four worst, in their independent opinions. These groups of boys were next ranked on the basis of my test and the correlation co-efficients were calculated by means of the method of 'Rank Differences' with the result that these were found to range from $\cdot 78$ to $\cdot 92$. The validity, therefore, is highly satisfactory on this count.

Next let us consider how far the findings of our test tally with expectations. In regard to a test in which the exercises are of varying difficulty values as they will appear to be in our present test, the test-makers have made two important assumptions (W. S. Monroe's Theory of Educational Measurements, pages 92, 145-46). First it is assumed that when an unselected

group of pupils, such as those belonging to a given school grade, is distributed according to a given ability, a 'normal distribution' is secured. The second assumption is that the variability of this distribution remains the same for successive school grades. Prof. Monroe says that these assumptions appear to be approximately in agreement with available data. A corollary to the first assumption, which too has been found to agree with facts, is that if the test of this nature is applied under the same conditions to groups of subjects of varying degrees of ability to be measured, the distribution will be 'negatively skewed or 'loaded' at the high score end in the case of the advanced group, positively skewed or loaded at the low score end in the case of subjects of lower ability and normal for the rest. The findings of our test tell exactly the same story. At Patna, the test was applied to 73 graduates and the resulting distribution was found to be negatively skewed or heaped at the high score end. The combined distributions for the two top classes of both Patna and Calcutta students or those for them singly are found to be almost exactly normal or symmetrical; while the corresponding distributions for the two lower classes are clearly piled towards the low score end.

The first of the above facts will be sufficiently clear to the reader from Table 1, where the skewness calculated from the graduates' group is shown, and it is as high as $-.72$. The other two facts will be vivid to the eye from Table 3 and also from the three graphs that follow, showing the relationship between the 'obtained' distributions and the 'best fitting' normal curves.

TABLE 3.

Calcutta Classes	Q_1	Median	Q_3	Mean	σ	Skewness
IX and X ..	10.4	14.7	18.8	14.86	5.5	+ .09
VIII and VII	5.9	9	11.9	9.57	5.0	+ .34
Patna Classes						
XI and X ..	10.7	15	18.9	15.07	5.78	- .03
IX and VIII	6.8	10	14	10.54	5.1	+ .32

In each of the following figures the obtained frequency distribution has been plotted in histogram and the 'ideal' normal curve has been drawn on the same axis of reference and of the same area,

mean and σ (sigma), in order to bring out clearly the relationship between the two.

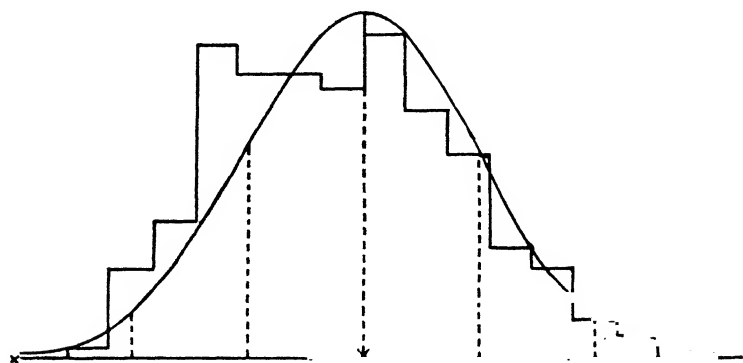


FIG. 1.

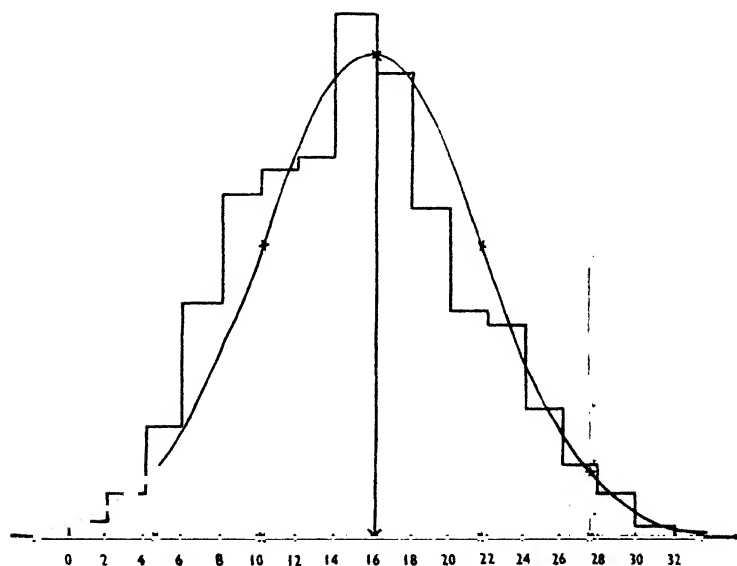


FIG. 2.

The χ^2 (chi-square) test being much too laborious, I have used this short-cut device to judge the 'goodness of fit by eye' and I think, this is quite useful for our purpose. To determine the theoretical curve in each case the ordinate at Y_0 ($X = 0$)

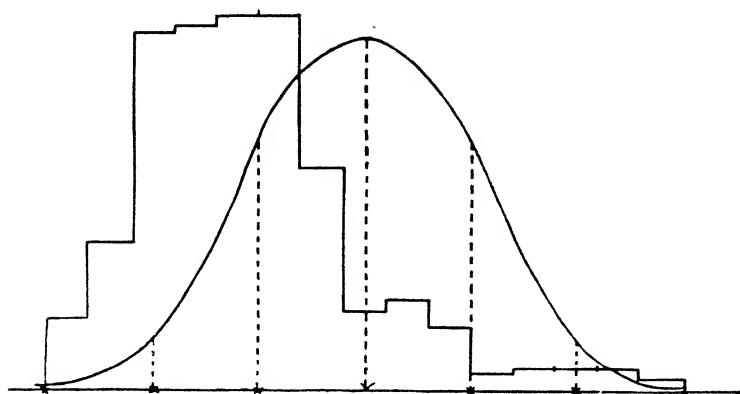


FIG. 3.

was discovered from the equation of the Normal Probability Curve

$$Y = \frac{N}{\sigma\sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2}}$$

and then the ordinates at $\pm\sigma$, $\pm2\sigma$, $\pm3\sigma$ (in units of step-intervals) were calculated from the table concerned (Garret's *Statistics in Psychology and Education*, pp. 125-127). The end-points of these ordinates were then joined by means of suitable lines to form the curve required.

From the first two figs. it would appear that the distributions tend to be normal, whereas the third fig. clearly shows that the distribution is far from being such. So, the first of Monroe's assumptions and its corollary fully agree with our findings and therefore one of the expectations comes true.

The reasons for the above phenomena are not far to seek. 'Too easy a test excludes from operation some of the factors which make for an extension of the curve at the upper end of the scale, whereas, too hard a test excludes from operation factors which make for the extension of the curve at the lower end of the scale.' Now the questions in our test are extremely easy for the graduates as anybody can see it, while they are a bit difficult for the lower form students. The two factors have their reflexion on their distributions. But, for the group of students belonging to the higher classes the questions involve factors that make for the chances of distribution and therefore, the extension of the curve even, on either side of the score-ends.

The second assumption of Monroe about the constancy of the variability of the distributions in grade groups has its origin in the findings of different test-makers in America, who have

established that the measures of variability such as σ (sigma), of a given ability or a group of abilities in successive grades tend to remain constant, although in many cases these seem to increase slightly as we advance from the lower to the higher grade. This position exactly agrees with the nature of σ 's in Tables 1, 2 and 3. So we see that the second expectation also comes true.

Besides the satisfaction of the two important expectations dealt with above, which are more or less scientific, other expectations from the layman's point of view may be found fulfilled. Tables 1 and 2 show that each measure of students' abilities, namely, Q_1 , Q_3 , median and mean, increases systematically from the lowest to the highest class, a fact which one naturally expects. Then again, a glance at Table 4 below, which is a consolidated list of percentage of correct responses secured from the students of Patna and Calcutta, will show that in a large majority of cases the responses decrease in magnitude as we advance from the higher to the lower classes. This also is what one expects to be. Thus we conclude that the validity of the test is established.

Of the three methods generally in use for determining the reliability of a test the 'repetition' method is the simplest and the best. This consists in giving the test and then repeating it to the same subjects and lastly in calculating the correlation between the first and the second sets of scores. The correlation thus derived is usually known as the 'reliability coefficient'.

In the present case, our test was applied to two classes at random in two schools at Patna sometime after its first application and the coefficients of correlation calculated by the 'product-moment' formula were found to be .82 and .94. The process might have been extended to other classes also, but as it would take much time and labour I had to remain satisfied with these coefficients only, which are without doubt sufficiently high.

The combined distributions for the two top classes both of Patna and Calcutta being normal, we can calculate the 'standard errors' of the respective means to show the extent of their reliability, thus,

For Patna students.

$$\begin{aligned}\text{The standard error of the mean} &= \frac{\sigma \text{ dist}}{\sqrt{N}} = \frac{5.78}{\sqrt{735}} \\ &= \frac{5.78}{27.1} = .21.\end{aligned}$$

The statistical interpretation of the above is that the chance is almost 99% of the true mean lying between $15.07 \pm 3 \times .21$, i.e. between 15.7 and 14.44.

For Calcutta students.

$$\text{The standard error of the mean} = \frac{5.5}{\sqrt{461}} = \frac{5.5}{21.5} = .25.$$

The chance is almost 99% of the true mean lying between $14.86 \pm 3 \times .25$, i.e. between 15.61 and 14.11.

Taking the two results together we may safely say that the 'true' average ability of all the students of the top classes in Bengal and Bihar lies between 15.7 and 14.11, or safer still, between 14 and 16. Thus, the deviations of the 'obtained' means from the 'true' being insignificant, their reliability is fairly assured. As there is no sense in applying this criterion to the two lower forms where the distributions are 'asymmetric', we may depend, in their case, only on the reliability coefficients found from the repetition method as stated above.

In a standardized objective test the qualifying word 'objective' is significant in that a test cannot be good unless the results secured therefrom are free from the subjectivity, i.e. 'the personal equation' of the examiners who mark the answers. In our test the objectivity is amply ensured. Each sum contains the minimum possible work-units, and one point score only is awarded to an answer if it is right and nothing if it is wrong. Thus the assessment of credit being based entirely on the principle of right-or-wrong, there can be no varying opinions, personal bias or the like, regarding the scoring of answers.

As regards the other criterion for the satisfaction of a test, namely, ease of administration and scoring, suffice it to say that in half an hour's time it can be administered to any number of students if only arrangements for strict invigilation are ensured. The ease of scoring will be secured if our 'answer-scale' is used in marking the answers. This is a printed strip of paper always attached to the test pamphlet containing the directions for use and interpretation of results. This strip of paper contains the numbers of the questions and their answers printed in such a way that it can be easily placed on the left hand side of each test paper so that the corresponding numbers of the questions in the two may exactly fit one with the other. Now the numbers of the questions with correct answers may be ticked off and counted, and their totals put down below. This facilitates the scoring to a degree not possible to attain in any examination with which we are acquainted.

Analysis of Students' Responses.

Apart from the measurement of the student's abilities in reasoning arithmetic for which the test was planned there is another important use, namely, the analysis of their responses from educational and psychological points of view. On actual counting it was found that out of 72,120 questions that were

presented to 2,404 students, 1,520 of Patna and 884 of Calcutta, 29,371 were correct and the rest either wrong or untouched. The correct responses were now taken up and counted for each class, question by question, and then their percentages were calculated class by class as well as *en masse*, as shown in Table 4. The column of the total percentages led to the ranking of the questions in order of their difficulty values.

A glance at the table will convince the reader that in a large majority of cases the percentage of correct responses tend to decrease from the higher to the lower classes. But on more careful scrutiny we find that in some cases, especially in the two lower forms their tendency seems reversed. In their attempt to answer some questions students of the lowest class appear to be positively ahead of those of the next higher class. What is it due to? The causes for this anomaly seem to me to be the following:—

In Bihar the students in Class VIII have just finished almost the whole of arithmetic in their Middle Classes, VII and VI, where the subject is taught four or five periods per week, whereas one or two periods a week are allotted to it in Classes VIII and IX. So they begin to forget in these latter classes most of what they have learnt in the middle stage and also lose much of interest in Arithmetic due to the introduction of two new subjects, Algebra and Deductive Geometry, to which more time and attention are given. Thus we can't blame the students if, in Class IX, they fare badly in their attempt to tackle some topics of arithmetic or do not make as much progress as they are expected to make. The same position, I presume, holds good in Bengal too.

Almost equal responses made by all classes at Patna to question 2 appear at first sight to indicate that this question is not suitable for the test. But the corresponding figures for the Calcutta boys do not confirm this view. In both the places the responses in the lowest class are about 50%; but while in Calcutta they rise up to 80% in the highest class, in Patna they remain stationary. On closer analysis of answers to this question we find that most of the wrong answers in Patna were due to the presence of the English words 'per pair' which the students must have thought as meaning 'one'. Now when we consider that the test was given in Bengali to boys in Calcutta and in English to all classes at Patna except in the lowest in which the sums were translated in Hindustani and Bengali, it will be clear that the percentage would have increased as in Calcutta had these been given in vernaculars in all the classes.

The percentage of correct responses as shown in the table can be easily utilized in transforming the test into what is called a 'Difficulty Scale'. The method is simple. Take the question for which the percentage of right responses is the largest as the easiest one, and put it first. Take the question for which

the percentage is less than the preceding one but more than any of the rest and put it second in ascending order of difficulty. Proceed in this way till the remaining question is reached, for which the percentage is the least and consequently the hardest of the questions.

The analysis of responses is of great help to the teacher of arithmetic. By such process he can judge by himself as to which questions are easy and which are difficult for his pupils of different classes and he can take steps accordingly. The Headmaster of a school may see how his classes are making progress by comparing the results of analysis of one year with those of the previous years.

A comparative study of the arithmetical abilities of the students of Secondary Schools in Bihar and Bengal.

When the arithmetical abilities as measured by our test of all the students who were our subjects were distributed in the same frequency intervals, and then represented graphically, as in Fig. 4, one for Patna and the other for Calcutta students, two bimodal curves of like nature resulted, each with one mode between 8 to 10 and the other between 14 to 18 point scores.

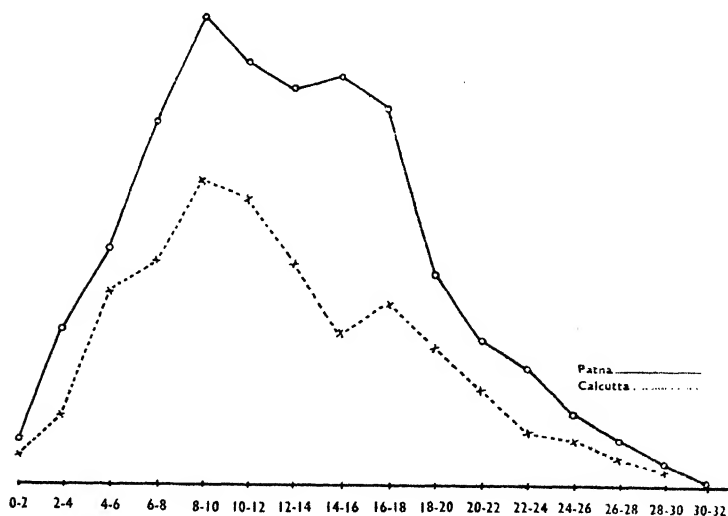


FIG. 4.

If we study this figure along with Table 3 we can easily conclude that in each case there are two distinct groups of abilities, one tending to be normal and the other non-normal.

This fact, which has been already dealt with, will be more clear from Figs. 1, 2 and 3.

Now let us go back to Tables 1 and 2. We find that each of the measures, Q_1 , Q_3 , median and mean, in both cases increases from the lower to the higher classes at rates that are almost equal to one another. One thing that comes out prominent on closer scrutiny of this rate of increase is the fact that it is extremely slight,—almost imperceptible,—from the lowest to the next higher class, but quite uniform from this latter class upward, and this will appear more clear from Table 5.

TABLE 5.

	Calcutta Classes	Q_1	Median	Q_3	Average
Difference between ..	X & IX	2.7	3.1	5	2.6
Do. . .	IX & VIII	3	3.9	5.3	3.9
Do. . .	VIII & VII	.8	.5	.2	.1
	Patna Classes				
Do. . .	XI & X	3	2.9	3.9	3.2
Do. . .	X & IX	2.2	3.4	2.3	2.4
Do. . .	IX & VIII	1	.6	1.5	1.2

The difference of measures between Classes IX and VIII in Patna is almost negligible while these are prominent and uniform between X and IX, and also between XI and X Classes. Similar is the case in Calcutta. But if we combine the distributions of Classes VIII and IX of Patna and VII and VIII of Calcutta, as in Table 6, we find that the rate of increase is now uniform to a great measure.

From what we have discussed above we may conclude without any fear of contradiction, that about a year's progress in arithmetic, if not in any other subject, is clearly lost to the boys during the first two years of their career in the four top classes of High Schools in both provinces. I have already given some hint about the causes that seem to lead to this situation and now I leave it to the teachers and educationists to ponder over it and devise some remedy if they can.

TABLE 6.

	Calcutta Classes	Q_1	Median	Q_3	Average
Difference between ..	X & IX	2.7	3.1	5	2.6
Do. ..	IX & (VIII & VII) combined	3.4	4.1	5.4	4
	Patna Classes				
Do. ..	XI & X	3	2.9	3.9	3.2
Do. ..	X & (IX & VIII) combined	2.7	3.7	3.1	3.1

Let us refer once again to Table 4 to compare the difficulties that the two groups of students found in answering the questions. Taking the percentage of correct responses of all the classes for all the 30 questions as given in the two total's columns and applying the 'product-moment' formula used for ungrouped series, namely,

$$r = \frac{\Sigma x^2 + \Sigma y^2 - \Sigma d^2}{2\sqrt{\Sigma x^2 \cdot \Sigma y^2}},$$

we have calculated the correlation of the difficulties as felt by the students of Patna and Calcutta as $r = .93 \pm .016$. This close relationship regarding the difficulties of the questions also appears to the eye if the two columns in which these are ranked, are carefully compared. Thus, the difficulty values of the sums tend to be the same for the two groups of students, although this is not so in regard to a few of them. Question 7, for instance, is the easiest for both the groups, but question 28 is the hardest for the Patna students and only 9th in the ascending order of difficulty for the Calcutta students. This fact seems to require more than a passing reference. From my personal experience in the field of the group test of intelligence I know that a high degree of intelligence is necessary for answering the question 28 correctly, and so I was not much surprised when I found that for the Patna students it was the hardest. But my surprise knew no bound when I found that this question was only 9th in order of difficulty for the Calcutta students, although they

lagged behind the Patna students in their responses to as many as 19 out of 30 questions.

The explanation of this phenomenon seems to me to be this: The innate, general ability ('*g*' factor?) of the students of Bengal, on the average, is quite high; but at present they are prevented from bringing their ability into full play in their school subjects on account of various extraneous factors, e.g., undue attraction to non-educational subjects, acute unemployment after Matriculation causing a general lack of interest in school study, unfavourable school conditions, etc.

There are three sums in the test namely, 3, 9 and 13, that involve measurement of area. The responses to these secured from the two groups are widely different,—the Calcutta students faring miserably in each, and one of these, namely, sum 9, has been found to be the hardest for them. This means that sums on areal and linear measurement are not properly taught in the High Schools of Calcutta.

As regards the sum 18 involving tackling of five different coins the percentage of correct responses of Calcutta boys is double that of Patna. Does it mean to say that the Calcutta guardians are more money-minded than their Patna confrères?

In conclusion let me extend my heartiest thanks to those Headmasters and teachers who were so kind to co-operate with me in conducting our test at their schools and also to my numerous students of the Patna Training College who volunteered their services in counting and computation of figures at various stages of my work. My thanks are especially due to the Headmasters of the three High Schools in Calcutta for their hospitality so freely extended to me and their esteemed help in carrying out my work there.

Patna Training College, }
Patna.

REVIEWS OF BOOKS.

THE TRAVANCORE TRIBES AND CASTES, VOL. II. By L. A. KRISHNA IYER. Published by the Government Press, Trivandrum, 1939.

The words 'and Castes' in the title of this work are misleading since the author states in his preface that the volumes are the result of twelve months' special duty from September, 1937, 'to complete the ethnographic survey of the Proto-Australoid element in the . . . State'. Records of the social and physical anthropology are given for fifteen tribes (eight in this volume), two more than were dealt with by the author for the 1931 Census. The additions are the begging Nayadis, the Parayans and Pulayans (with the previously included Thantapulayans) who are descended from agrestic slaves and are not Hill Tribes. These three peoples are treated in over half of the 260 pages on social anthropology in Volume II. Little if anything new is added to their ethnology as previously recorded by Aiyappan and Ananthakrishna Ayyar except an interesting account of slavery in Kerala and of recent progress in social uplift, also lists of kinship terms and clan names for the sub-groups of Parayans and Pulayans. The chapter on the Muthuvans gives a good non-technical account of the tribe and its life, but no reference is made to the author's earlier paper on these people. There is a useful map at the beginning of each chapter to show the geographical distribution of the tribe taken up and a frontispiece map of Travancore which gives the distribution of all the tribes treated in both volumes. There are over one hundred photographs in this volume, some of which are very good and will be particularly appreciated by non-Malayalis.

Each of the eight tribes is treated in a separate chapter under several heads such as: origin, structure, marriage, pregnancy, birth, puberty and funeral customs, religion and appearance. These headings are well indexed at the end. Since the author is a Forest Officer readers will regret that very little attention has been paid to ethnobotany. Four of the tribes (Nayadis, Paliyans, Uralis and Vishavans) numbered less than one thousand in the State in 1931. The treatment of these can be characterized in the words of the review of Volume I given in '*Nature*', it 'repeats and amplifies the admirable synopsis of the Census Report for 1931, based on the author's notes'.

The last chapter of 61 pages on physical anthropology contains new material of interest to the professional anthropologist. After a general discussion of the effects of environment, anthropometric work in India and of skin and hair characters, measure-

ments for the following definite characters are given for sixteen tribes (Pulayan and Thantapulayan account for the extra one): Circumference of chest, stature (with percentages of pygmy, short, medium and tall), cephalic and nasal indices (with percentages of three types in each). The samples are of a good size, especially for India, only six are less than 50 and four are over 100, including Kanikkar sample of 240. Beyond the mean for each character and the standard deviation no other data are given. These characters are discussed with excerpts from various anthropologists together with the racial position of the tribes. The author identifies them with the Nishadas of the Vedas and follows other workers in attributing to them a Negrito-proto-Australoid (or pre-Dravidian) descent. He holds with other anthropologists that the more isolated the tribe the higher the nasal index, the more it has crossed with surrounding people the lower the index. At the end there are sixteen lithograph plates with two to four distribution graphs on each for stature, cephalic and nasal indices for each tribe. There is an appendix containing two Pulaya songs in Malayalam, a good general index and an index of exogamous clan names. In a 54 page introduction Baron von Eickstedt contributes a useful outline of the history of anthropological research in India and attempts to force the adoption of a clumsy 'ternary nomenclature of the Indian race types' in which most of the names are quartern, with threats against 'priority' iconoclasts. Since no two taxonomists agree as to the exact nature of species, let alone sub-species, race and 'type', any attempt to erect a rigid technical nomenclature to include them all in modern man can result in nothing more than an academic curiosity. He omits to say where the type specimens of his *Homo sapiens indomelanicus kolidus* and other 'race types' are filed. In his conclusions Mr. Iyer discards Eickstedt's popular designation of 'Weddids' for his tribes, together with 'the time-honoured appellation' of Pre-Dravidian and gives his vote for 'Proto-Australoid' with Sewell and Hutton.

Because the subject-matter dealt with is so important to anthropology and of such interest to cultured persons everywhere it is regrettable to discover signs of inaccuracy, haste and slipshod writing in this work which cannot but cast doubt on the validity of the other data which the reader cannot check. *Examples of Inaccuracy*: (a) in Tables IX and X data for Malapantaram, Malavetan, Muthuvan and Kanikkar differ from the same data given for the same tribes in Table VII and previous tables, e.g. Malavetan Nasal Index in Table VII = 89.77 in Table X = 92.7; (b) under *Muthuvans* we read 'When a girl attains puberty at the age of fifteen, she is lodged in a separate shed, etc.' What happens if she is younger is not stated. Under 'Vishavans' we learn 'Girls generally attain puberty at about the age of twelve'; (c) Tallness in Uralis is laid to their elevated

environment and their robust build 'is due to the rarified air of 3,000 feet'. On the other hand, the fact that the tallest tribe is the Southern Pulayas of the lowlands is credited to 'the dry healthy climate and high nutritive content of their food' (no account is given of this valuable diet). *Examples of hasty work and slipshod writing:* (a) The author's conclusion after thirteen pages about the Paliyans: 'The Paliyans are good singers like the Mannans. They are lazy and try to carry on with the minimum of labour.' (b) His conclusions for twenty-four pages on the Ullatans is a quotation from Visscher who wrote in 1862 that they wear no clothing 'and regard the tiger as their uncle' and recorded customs with regard to this 'relative' to which Mr. Iyer adds, 'They no longer observe these customs'. (c) From page 182, we learn that among the Pulayas 'to be crossed by a cat' is a bad omen.

The work is evidently faulty but because of the intrinsically valuable subject both this and the previous volume will make very interesting reading for the undergraduate and lay reader. A glossary of the Malayalam terms would have been helpful.

Throughout Volume II the bibliographical references are given in footnotes and on the very last page there is an alphabetical list of bibliography. The latter is most incomplete, in many cases authors' initials and dates of publication are omitted; Ernest Crawley is placed under *E*, Herbert Spencer under *H* and Robert Lowie under *R*. All this must embarrass the gentlemen who are thanked for help in editing in the author's preface.

Those who have already purchased Volumes I and II may be interested to learn that Volume III is merely a repetition of what has been given with a transcription of the article on 'The Primitive Tribes of Travancore' by Iyer and Pillai from Volume I of the 1931 Census of India.

E. W. E. MACFARLANE.

THE TRAVANCORE TRIBES AND CASTES. THE ABORIGINES OF TRAVANCORE, Vol. III. By L. A. KRISHNA IYER. Published by the Government Press, Trivandrum, 1941.

The author in his preface says that this last volume of his work contains his 'conclusions on the study of the tribes to which blood grouping studies have yielded additional evidence. It attempts an interpretative glimpse of the inner life of the tribes ... It gives an exposition of primitive culture in all its aspects'.

After a short introduction by Professor Marett the first chapter is a transcription of pages 262-279 in the last chapter of Volume II on physical anthropology. Even the same mistake is repeated on page 11 of attributing to Hodson an excerpt from

Guha's introduction to the 1931 Census Report. Then follows Chapter II 'Traditions of Origin' which is an exact transcription from pages 231-233 of the article by Iyer and Pillai in 1931 Census of India, Vol. I, although this is not referred to by footnote nor in the list of bibliography. Chapter III is a transcription of the second half of the last chapter of Volume II, including the conclusions in full; two pages about blood group data are interpolated. The tables of physical measurements, with the same inaccuracies, are copied from Volume II but they are no longer numbered consecutively, those in Chapter III starting off as Tables I, II, etc. again. On page 34 Iyer says: 'I give below the results of my study based on extensive measurements of the primitive tribes of Travancore.' Two tables follow (Chap. III, Tables I and II) and the first contains Thurston's data without his name being mentioned; in Volume II, Table VI, the same data are given as 'recorded by Thurston'. At the back of the volume the same lithograph charts from Volume II are reproduced, together with the same error of giving the scale for the distribution charts of cephalic and nasal indices as '1 inch = 10 cms.'

Chapter IV on Megalithic Monuments is also transcribed from the 1931 Census Report with a few sentences added. Chapter V on Domestic Life is taken partly from the Census Report and partly from the author's paper 'The Primitive Culture of Travancore' (*Proc. Ind. Acad. Sci.*, 4: 435-453, 1936), which is not referred to in the bibliography either. These two older papers by the author have also been resurrected to make the next six chapters, with the addition of an occasional sentence or paragraph here and there.

Nearly all the data on social anthropology in Volume III were thus already collected in 1931, nearly ten years ago, and now they are presented again as 'conclusions'.

The blood grouping data of Dr. Karunakaran for 211 Kanikkars in Chapter I are interesting in that they differ from those for other West Coast Tribes in showing more of Group B than of Group A. The author, however, insists that the figures 'very nearly approximate' those for Australians (who are known to be almost devoid of Group B) and attributes the 29.8% Group B in the Kanikkars to 'miscegenation with the high caste Hindu'. The three tables presenting blood group data have no numbers. In the second the data for 'Pre-Dravidians' taken in Cochin State by Macfarlane are here attributed without evidence to the Kadar Hill Tribe. The papers from which other blood group data are taken for comparison are not given in the bibliography.

The following definition of *Hinduism* on the chapter on Religion is apparently new to the author's writings and one wonders how it would have been received from a non-Hindu—'animism more or less transformed by philosophy, or to condense the definition, as magic tempered by metaphysics'.

There are over sixty photographs, some very good, most of which have already appeared in the Census Report and in the first two volumes. There is an index, an alphabetical list of names of endogamous clans and an incompletely documented bibliography.

For those who have not already purchased the first two volumes of this work the third volume provides a lot of interesting matter about some fascinating tribes in a handy form with good illustrations.

E. W. E. MACFARLANE.

CLASSIFICATION OF FISHES, BOTH RECENT AND FOSSIL.¹

In 1924, while reviewing some American work on recent and fossil fishes, it was pointed out by the late Dr. N. Annandale and the present writer² that as regards bibliographical monographs ichthyologists are perhaps in a much better position than the students of any other group of animals. The great value of the monographs then reviewed has been fully realized during the last 17 years and at the present day no serious student of fishes can be without Dean's 'A Bibliography of Fishes', of which another volume is long overdue, and Jordan's 'The Genera of Fishes' and 'A Classification of Fishes'. From time to time, C. Tate Regan has been publishing an elaborate classification of all the recent fishes based on his own extensive osteological researches, and in 1929 he codified these in his article on 'Fishes' (pp. 305-328) in the 14th edition of *Encyclopaedia Britannica*. As no reprints of this learned article were published, it is unfortunately not easily accessible to many ichthyologists and has, in consequence, been little used. Quite recently, the Russian savant, Professor Leo S. Berg³, has brought out a work of unusual interest on the classification of fishes, in which he not only gives his views but includes concise and critical summaries of the earlier systems of classification and in foot-notes refers to the relevant recent literature on the subject. In the text brief notices are included upon the geological and geographical distribution of the families and the names of extinct groups of fishes are marked with a dagger. The structural peculiarities characteristic of the various groups are well illustrated.

¹ Berg, L. S.—Classification of Fishes, both Recent and Fossil. *Travaux Inst. Zool. Acad. Sci. URSS*, V, pt. 2, pp. 517. (Russian text up to page 345), 190 text-figs. (1940).

² Annandale, N. and Hora, S. L.—Fish: Recent and Fossil. *Journ. Proc. Asiat. Soc. Bengal (N.S.)*, XIX, pp. 101-103, 1923 (1924).

³ Professor L. S. Berg was awarded the Society's Joy Gobind Law Memorial Medal in 1936 for conspicuously important contribution to the knowledge of Zoology in Asia.

Berg is of the opinion that there is no reason to apply the rule of priority to taxonomic units higher than genera, and, therefore, for families he has adopted names widely known in literature. In this connection, he makes the following observations, with which the reviewer entirely agrees:

'Some authors believe, for some reason or other, that families must bear names after the first described genus. Such an obligatory rule does not exist, and the use of that principle can only lead to confusion. As concerns the genera, we adopt, generally speaking, the principle of priority, but within reasonable limits. I think it is inadvisable to reject, in deference to a "law" of priority, the old names which are widely used in the anatomical and biological literature and to replace them by names extracted from worthless and justly forgotten writings of a Rafinesque or Swainson. It seems to me that the long practice, of more than half a century, in the application of the "law" of priority has shown the complete worthlessness of this principle. Instead of putting the nomenclature in order it has thrown it into an inextricable confusion. Owing to the "law" of priority, it happens not infrequently that even a specialist cannot, without special references, make head or tail of the nomenclature.'

It is suggested that as regards genera 'enquiries into priority beyond the limit of XIX century should be prohibited (except, of course, for Linne); moreover, as regards the genera of Cuvier, which are widely used in the anatomical and biological literature, the rule must be established that "la recherche de priorité est interdite". On the whole, I agree with Heikertinger that the "law" of priority cannot be observed when we have to do with names having a wide currency'.

The above observations on the law of priority deserve very serious consideration, and it is time that a more workable nomenclatorial system should be adopted. At present, much time has to be spent in hunting for older names and justifying their use in current literature.

Seeing the mass of valuable information, properly documented, on the classification of recent and fossil fishes that has been brought together by Professor Berg in this work the great debt we owe to him is clear without further comment. Our gratitude is still greater, for besides the Russian text, there is a complete text, with the exception of text-figures, in English also. References to text-figures are, however, given in the English text and the explanations of the text-figures in English are also appended.

S. L. HORA.

INSTRUCTIONS TO AUTHORS FOR THE SUBMISSION OF PAPERS FOR PUBLICATION IN THE JOURNAL AND MEMOIRS OF THE SOCIETY.

PAPERS

1. All communications submitted to the Society for publication should be addressed to the General Secretary and not to any officer by name. They should be type-written on one side of the paper with sufficient margin on the sides, and *in all respects must be absolutely in their final form for printing.*

2. Papers must be accompanied by a brief abstract not exceeding 1,000 words, which shall indicate the subject of the paper and the nature of the advance in the existing knowledge on the subject.

3. Tables of contents (for long papers), references to the plates and literatures, etc., should be given in their proper places.

4. Quotations in Oriental languages should be in the original script, and wherever they are transliterated the System of Transliteration adopted by the Society must be followed (see instruction 15). The names of *genera* and *species* in the case of biological communications should be underlined to indicate that they are to be printed in italics.

ILLUSTRATIONS

5. All drawings and photographic prints should be as clear as possible. They should be in a form immediately suitable for reproduction, preferably of a size to permit reduction to about two-thirds the linear dimensions of the original, and should be capable of reproduction by photographic processes.

6. Drawings and diagrams to be reproduced as line blocks should be made with fixed Indian ink, preferably on fine white Bristol board, free from folds or creases; smooth clean lines or sharp dots, but no washes or colours should be employed for shading. The positions of the illustrations that are to appear in the text must be clearly indicated in the margin of the paper; and explanations of the figures should be typed at the end of the main paper with the indication: *Explanation of text-figures.*

7. The maximum space allowable for illustrations in the *Journal* and the *Memoirs* are as follows:—

Journal, text, 3½" × 6½"; Plates, 4½" × 7".

Memoirs, text, 6½" × 9"; Plates, 7½" × 9½".

These spaces include the usual figure numbering. Explanations of the plates to be printed on separate pages, facing the plates, must be typed on separate sheets.

PROOFS

8. A proof of each paper will be sent to the author, on the address given on the MS.

9. No alteration or addition necessitating any considerable change of type may be made in the proofs. Should such alterations or additions be necessary, these must be added as footnotes duly dated and initialled. The cost of corrections made in the proofs should not exceed 20% of the printers' charges for the setting of the paper; any excess will be charged to the authors.

10. The proof must, if possible, be returned within one week of the date of receipt to the Society duly corrected.

MISCELLANEOUS

11. Authors of papers published in the Society's *Journal* and *Memoirs* are entitled to receive *gratis* 30 copies of each paper, and as many more as they require on payment of the cost of printing, paper, and make up. Such requirements must be stated at the time of returning the proofs.

12. Papers by non-Members of the Society must be communicated through a Member, who shall satisfy himself that the paper is suitable for presentation to the Society, and is ready for the press.

13. No communications under consideration or accepted for the Society's publications may be published elsewhere without the express sanction of the Council.

14. To facilitate the compilation of indexes, each author is requested to return to the Society together with the proof, a brief index of the contents of the paper. These indexes will be edited and incorporated in the volume when completed.

15. The following systems of transliteration are henceforth to be followed (as far as practicable) in the publications of the Society, in quoting non-European words as such. In giving names of places, authors or books, which would occur in the course of the English text, a 'broad' transcription, following English values of the consonants and avoiding diacritical marks, is recommended.

SANSKRIT

अ = a आ = ā इ = i ई = ī उ = u ऊ = ū
 ए = e ऐ = ai ऋ = ṛ ॠ = ṛ ए = e (or ē) ऐ = ai (or ai)
 ओ = o (or ō) औ = au (or au) (Prakrit अर अउ = ai, au)
 ऽ (Anusvāra) = ṁ : (Visarga) = ḥ × (Jihvāmūliya) = ḫ
 ॡ (Upadhmāniya) = φ

Sandhi Vowels may be indicated as â î û ê ô. Avagraha = '.
 Accents in Vedic—Udātta á â etc. Svarita—â.

क ख ग घ ङ = k kh g gh ṅ (or ṇ)
 च छ ज झ ञ = c ch j jh ñ (or ṇ)
 ट ठ ड ढ ण = ṭ ṭh ḍ ḍh ṇ
 त थ द ध न = t th d dh n
 प फ ब भ म = p ph b bh m
 य र ल व = y r l v (or w)
 श ष स ह = ś ṣ s h
 ळ ऴ = ḷ Ḵ

HINDI (and other North Indian Speeches)

As for Sanskrit, only nasalised Vowels are to be indicated by a tilde mark (~) above the Vowel (e.g. अँ अॉ अँ अँ = ā ã ū ai, ai).

etc.), and ढ ढ are to be denoted optionally by either d dh or by r rh. Care should be taken in distinguishing ब and व (b and v)—the latter preferably may be written as w rather than v, specially in intervocal and final positions. The final silent -a may be optionally omitted : but in quoting Early Hindi, etc. the final a should be retained. ठ ढ as in Rajasthani, Panjabi, etc. are to be indicated as in Vedic.

BENGALI

The system for Sanskrit, with the provision for nasal Vowels and for ড ঙ (= ङ ङ) as in Hindi. For ব (অন্তঃস্থ ব), in all *tatsama* or pure Sanskrit words, *y* should be employed, in Prakritic and semi-*tatsama* words, *j*; subscribed ব (= ব-ফলা) should be indicated by *y*. The difference between বর্ণীয় ব (= b) and অন্তঃস্থ ব (= v, w) need not be indicated for Bengali—b may be written for both : only subscribed ব (ব-ফলা) is to be written as *w* (e.g. Skt. *Viśvāsa* = Bengali *Biśwās*). Final -a may be omitted optionally, but it should be retained for Early Bengali.

ARABIC

In transcribing Arabic, according to the context either (i) the native Arab pronunciation (as current in the *Jazīratu-l-‘Arab*) or (ii) the Perso-Indian pronunciation may be followed.

(i) Arabic in native Arab Pronunciation—

أ (alif hamza) = ’; ب = b, ت = t, ث = th (or θ) ; ج = j (or g), ح = h, خ = kh (or χ, or x) ; د = d, ذ = dh (or δ) ; ر = r, ز = z ; س = s, ش = sh (or š) ; ص = s, ض = d ; ط = t (or t), ظ = z (or z) ; ع = ’, غ = gh (or γ) ; ف = f, ق = q ; ك = k ; ل = l ; م = m ; ن = n ; و = w, ū ; ه = h ; ي = y, ī.

— respectively = a, i, u (or ē, ō optionally in place of i, u), ا = a, i, u ; آ = ā ; إ = ī ; و = ū ; ع = ay (or ai) ; اء = aw (or au) ; *tanwīn* = ^{un, an, in} above line ; ى = á. (Note : عبد الحق = ‘Abdu-l-Haqq, or ‘Abd al-Haqq, not ‘Abd-ul-Haqq.)

ة = t (or h, or th).

(ii) Arabic in Perso-Indian Pronunciation, in the case of the following letters—

ث = ś, ذ = ź, ص ض = ṣ ṣ, ط ظ = ṭ ṭ.

PERSIAN

As for Arabic in Perso-Indian Pronunciation, with the following special Persian letters added :

پ = p, چ = ch (or c, or č), ژ = zh (or ž), گ = g.

و may be indicated for Persian by v rather than w.

For Early Modern Persian, and Indian pronunciation of Persian, the *majhūl* sounds of و and و (= ē, ō) may be employed side by side with the *ma'rūf* sounds (= ī, ū).

و = au, ai. Nasalisation (*nūn-i-ghunna*) may be indicated by *tilde* mark (~) on the top of the Vowel, as in the case of Hindi, etc.

Hā-i-mukhtaḥḥ can be represented optionally as ah or a.

The *Izāfat* is to be written as -i- (or -ē- optionally).

URDU

As for Persian, only و = w, rather than v. See also the directions for Hindi. The special Urdu letters in the Perso-Arabic alphabet for Urdu are to be transcribed as in Hindi, e.g. ث = ṭ, ذ = ḏ, ژ = ṛ (or ṛ).

TAMIL

In transcribing Old Tamil, the modern pronunciation should not be followed—an exact transliteration will be enough for the purpose. This is in case of the consonants, which for Old Tamil should be indicated as below :—

க = k (never g, even medially) ;	ங = ṅ (or ŋ)
ச = c (never ś, or j) ;	ஞ = ñ (or ɲ)
ட = ṭ (never ḍ, even medially) ;	ண = ṇ ;
த = t (never d, or th) ;	ந = n ;
ப = p (never b, or v) ;	ம் = m ;
ய ற ல் வ = y, r, l, v ;	ள் = ḷ ; ன் = n' ; ற் = r' (ன்ற = n'r',
not ndr ; ற் = r'r', not tt) ;	ழ = ṣ (or ḷ) ; ூ (āytam) = ḥ.

Long ē and Long ō are to be distinguished from the corresponding short vowels by the *macron* or length mark—the short e and short o being left unmarked.

TIBETAN

Vowels—	a	i	u	e	o
Consonants—	k	kh	g	ṅ	(or ŋ)
	c	ch	j	ñ	(or ɲ)
	t	th	d	n	
	p	ph	b	m	
	ts	tsh	dz	w	
	ž	z	'	(or ɦ)	
	y	r	l	š	s h

Silent letters need not be attempted to be indicated in transcription, but if necessary, the modern pronunciation may be denoted by some consistent system of phonetic transcription within brackets after the transliterated Tibetan (or *vice versa*).

CHINESE

Usually the North Mandarin Pronunciation should be represented, in Wade's system, with tones denoted by numerals. As far as necessary or practicable, the original Chinese character and the reconstructed pronunciation of it in Ancient Chinese should be given within brackets.

JOURNAL
OF THE
ROYAL ASIATIC SOCIETY
OF BENGAL

LETTERS

VOLUME VI

1940

Some Aspects of the Cultural Life of the Khasas of the cis-Himalayan Region.

By D. N. MAJUMDAR.

(Communicated by Dr. B. S. Guha.)

INTRODUCTION.

Over a great area of the Himalayan region, both trans-Himalayan and cis-Himalayan, it is customary for a man to share his wife or wives with his brothers. This is known as fraternal polyandry as distinguished from the matriarchal polyandry that used to be commonly practised in Malabar where the husbands of a woman were not necessarily related to one another. In fraternal polyandry, the wife comes to live with the group of husbands; in the matriarchal form, she remains in her own house, the husbands come to live by turn as visitors. Property under the fraternal type of polyandry passes from father to son, in the matriarchal type, the woman owns it and passes it on to successors in the uterine line. Polyandry appears to have been a widely practised form of marital relationship, and though some authorities tried to nail down polyandry to the name plates of non-Aryan, Tibetan or Dravidian tribes or castes, there is no doubt that Indo-Aryans and their progenitors did preserve this institution, within limits, and today, the various Indo-Aryan tribes living in the region of Turkestan, Hindukush and the cis-Himalayan area are definitely polyandrous. Whether polyandry is a racial trait or not, today it is a system of marriage affecting the lives of at least 30 millions of people.

The Himalayan region contains three important ethnic groups, which have mixed in varying proportions to produce the many types and groups that one meets in these parts. These comprise, as it were, three bands of ethnic formations. The highest altitudes are inhabited by the Mongoloid races whose nomadic incursions into the south, south-east and south-west have contributed to 'yellow' infusion among the descendants of the Indo-Aryan immigrants in these parts. The advance of the Indo-Aryans into the Punjab was marked by successive waves of immigration. They were first established in the sub-Himalayan districts of the Punjab. The plain of the five rivers must then have been dense jungle interspersed with large marshy areas. On reaching the plain, the immigrants could have turned in two directions, either east along the north of the

plain, or southwards along the Baluchistan border. They probably followed both these ways. As a knowledge of agriculture was not unknown to these immigrants, some of them naturally chose the foot-hills to which they had been accustomed while in Turkestan. The penetration of the various Indo-Aryan hordes into the hills and inaccessible tracts may also be due to the fact that the earlier immigrants came in conflict with the incoming hordes who drove them from their original settlements, and the former had to take shelter in distant hills and were given the most opprobrious epithets. The aboriginal population which is Austric or pre-Dravidian is represented by the Dom, a generic name which also includes many artisan castes most of which are hybrids being offshoots of mixed marriages between the Indo-Aryan invaders and the aboriginal races. The Indo-Aryan immigrants who still dwell in their original settlements may have maintained their racial purity, but those of them that have wandered away from their home and have penetrated into secure asylums in the hills and forests have not, though as a result of their settlement among inferior races they established their cultural dominance over the latter. Consequently, the highland regions of the Himalayas form even today a residual island which still preserves social customs that once had probably a more extensive distribution.

The 'Khasas' or the 'Khasiyas' who constitute the high caste people of the cis-Himalayan region are either Rajput or Brahmin, though intermarriage between them has not been barred by the rules of caste endogamy. The artisan castes are recruited from the Doms whom the Khasas brought with them or subjugated. The Rajputs and Brahmins have freely mixed with immigrant people but have preserved themselves from contamination by the infiltration of Dom blood by strict prohibition of marriage with the artisan castes. The latter are decidedly of inferior social status and looked down upon by the Khasas as such. There has been some infusion of Mongoloid blood among the Khasas but it has not occurred to any appreciable extent in Jaunsar-Bawar. It is found in Gharwal and adjoining States and is probably due to Tibetan influence.

The Khasas are usually tall, handsome, fair (rosy or sallow white) complexioned, possess long heads, vertical forehead, fine or leptorhine noses, hazel eyes with a sprinkling of blue, curly hair and other features wellcut and proportioned. The women are also comparatively tall, slender and graceful, of a very attractive appearance and extremely jovial disposition. There is little difference in physical features between Khas-Brahmins and Khas-Rajputs, and intermarriage must have taken place and does take place even today. The mean stature of 100 Khas-Brahmins is 163.3 cms. and that for 100 Khas-Rajputs is 162.4. The mean cephalic indices are 71.33 and 71.60 respectively. The nasal index (mean) for 100 Khas-Brahmins is 66.29,

that for the Khas-Rajputs is 67·25. As the results of anthropometric measurements of the Khasas will be published separately, further details will not be given here. The Khasas are conscious of their superior lineage, for they affiliate themselves to the Pāṇḍavas of the Mahābhārata fame and are indeed proud of their polyandrous custom, as they say it was the usual practice among their progenitors, the Pāṇḍavas.

There is ample evidence of the physical similarity of the Khasas with the Kasmiras and there is remarkable similarity of the Khasa family law with the Punjab customary law, notably with customary law in the Kangra hills. The reference to Khasas along with the Kulutas (residents of Kulu), Tanganas and the Kasmiras in the Brihat Samhita, and of the occupation of Madhyadesha by the Khasas and the Śakas in the Viṣṇu Purāṇa, Hari Vamsa and in the Mahābhārata go to prove the antiquity of the Khasas. The Khasas most probably occupied various parts of northern India in prehistoric times, and there is some truth in the statement that they occupied large areas from Kashmir to Nepal. The fact that the Khasas are described in the Mahābhārata (Droṇa Parva) as having arrived from diverse realms corroborates the above hypothesis. Manu refers to the Yavanas several times in his code of laws along with the Śakas, Kambojas and other rude tribes on the borders of India. In one place (X. 43 and 44) he writes as follows: 'The following races of Kshatriyas by their omission of holy rites and by seeing no Brahmins, have sunk among men to the lowest of the four classes: viz., Paundrakas, Odras, Dravidas, Kambojas, Yavanas, and Śakas; Paradas, Pahlavas, Chinas, Kiratas, Daradas and Khasas'. These are all described as Dasyus or wild people who were descendants of the four original castes, mixing promiscuously with one another and neglecting their religious observances (Book X. vv. 12 to 24). In the Mahābhārata it is said that these tribes of Kshatriyas have become Vrishalas from seeing no Brahmanas (Muir's Sanskrit texts, 2nd Edition, I, p. 482).

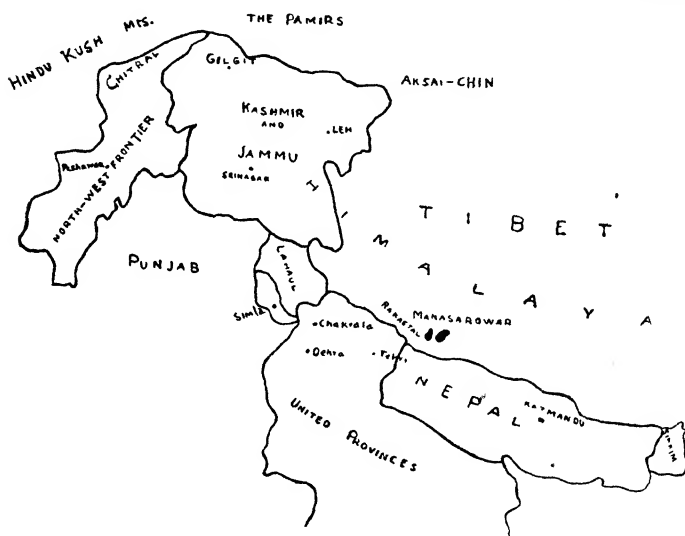
The Khasi clans of Assam are not related to the Khasas of these parts, for the physical features of the two groups differ considerably and unless we suppose a large scale mixture of the Khasas with the Mongoloid tribes of Assam, the Mongoloid features found among the Khasis and absent among the Khasas are difficult to explain. The Khasas probably represent the eastern outpost of Indo-Aryan penetration in the cis-Himalayan region. A. C. Turner writing about the Khasas (Census Reports, Vol. I, pt. III, p. 24) quotes relevant evidence to prove that the occupation of the Khasas took place long before the Christian era.

I propose to describe below the culture pattern of the Khasas or Khasiyas of the cis-Himalayan region. For purposes of intensive investigation, I have confined my study to Jaunsar-

Bawar in the Dehra Dun District, though my observations apply equally to other parts of this culture area.

The Physical and Economic Geography of Jaunsar-Bawar.

The district of Dehra Dun which occupies the northernmost part of the Meerut Division in the United Provinces, lies between $77^{\circ} 35'$ and $78^{\circ} 20'$ east longitude and $29^{\circ} 57'$ and $31^{\circ} 2'$ north latitude and has an area of 1,193 square miles. Geographically the district is divided into two regions—the Dun proper, which is an open valley enclosed by the Siwalik hills, and the outer scrap of the Himalayas, and the hill Pergannah of Jaunsar-Bawar which is the hill appanage of the Dun. The latter is a roughly oval tract of hilly country with its major



axis lying north and south. The boundaries of these two tracts, viz., the Dun proper and Jaunsar-Bawar, are sufficiently clear and well marked. The Dun valley is enclosed within the Himalayan range, the Siwalik hills and the rivers Ganges and Jumna. The river Tons sweeps round Jaunsar-Bawar from the north and finally with a 'course trending the main south joins the Jumna near Kalsi'. To the north and east of Jaunsar-Bawar lie the States of Tehri, Jubal and Sirmoor, and to the south lies the Dun valley. For administrative purposes, Jaunsar-Bawar is included in the Chakrata sub-division of the Dehra Dun district. The whole of this tract is rugged and full of precipitous mountains with little level ground. There are many tall peaks varying in height from 5,000 to 12,000 ft. and some of these give off ridges, which 'suddenly descend to dark chasm'. The rocks are mostly of lime-stone which account for the irregular and

massive formations. There are many ravines, some bare, some wooded, while the valleys are covered with fine grass enabling herds of buffaloes to live and multiply and supply milk for the *ghee* industry.

Jaunsar-Bawar contains large tracts of forest area and numberless hills densely covered with tall trees and thick vegetation. Few villages are found in these hills as land for agriculture is not available, the declivity of the slopes being too steep for cultivation. The chief species of trees are the *Deodar* (*Cedrus deodara*), the *Chir* (*Pinus longifolia*) and the *Kail* (*Pinus excelsa*). The last is a variety of *Chir*. *Deodar* and *Chir* are both of great commercial importance, and are used in the construction of houses and manufacture of railway sleepers. *Chir*, though not so durable or important as the *Deodar*, is still of great commercial value. Besides supplying timber, turpentine and rosin are extracted from its resin. There are also other species like the *Ban* (*Quercus incana*), *Moru* (*Quercus dilatata*), *Akhrot* (*Juglans regia*), *Darbi* (*Cedrela serrata*) and *Thuner* (*Taxus baccata*). All agricultural implements, the wooden parts of them, are made from *Moru* which also supplies walking sticks. *Akhrot* gives fruit (walnuts) rich in fat while the wood is specially used for making butts for guns and the bark of the *Thuner* serves as a substitute for tea. A number of species of fruit trees are found in the hills, such as *Amla* (*Phyllanthus emblica*), *Hinsar* (*Rubus* species), *Kingar* (*Berberis* species) and *Mol* (*Pyrus pashia*).

There are a number of rivers and rivulets in Jaunsar-Bawar though few of them are perennial streams. In the summer months they dry up and water is only available in deep water holes and gorges sheltered from the heat of the sun, but during the rains, they are roaring torrents, full and swift. The economic value of these rivers lies in the cheap carriage they provide to timber felled in the forests. The difficulty of transport is great in the hills and is minimized in the case of sleepers by the small '*gads*' (rivulets) which are used for transporting them. As there is hardly any market for timber in the hills, it is carried down to the plains and the rivers and streams help in facilitating such transport. Where there are no *gads* the sleepers made on tops of hills are carried down by the dry-sliding method or by human labour; the latter is indeed a painful process particularly where the descent is precipitous. After the sleepers are brought near the *gads*, there is a further difficulty to overcome, for there is seldom enough water in the *gad* to carry the sleepers down with the current. An artificial channel is made by damming water at a distance and the sides of the streams are carefully planted with sleepers in such a way that water may not escape through the gaps in the arrangement. These are stopped by covering the escapes with leaves and grass. When an artificial channel about two furlongs or so is thus made, the sleepers are

put in the water and are pushed towards the *dam*. In this way all sleepers are made to accumulate at the end of the artificial channel which is broken from the mouth and then they float down. A new channel is again made, the process continues till the sleepers reach big rivers like the Jumna or the Ganges which contain water sufficient for transporting them further down. Although the Forest Department spends huge sums of money every year, the indigenous inhabitants seldom take advantage of employment in these forests. The bulk of labour skilled as well as unskilled comes from outside, the skilled from the Punjab and the unskilled from the neighbouring States and Garhwal.

Jaunsar-Bawar forests are rich in natural fauna: *Kasturi* (Musk deer), *Bar Singha* (stag), *Bhālu* (bear), *Sāhi* (Porcupine), *Bāgh* (Panther), *Ead* (Flying Squirrel) and many other species of animals are found. The Khasas eat flesh of *Kastura*, *Ther*, *Barad*, *Bar Singha*, *Ghold*, *Kakhar* and the skins are used for various purposes. There are plenty of birds, *Unal*, *Titar*, *Chakor*, *Phakbons Battak*, *Murgi* whose flesh the people eat, but they do not eat crows or pigeons. The forests are grouped into different classes, some reserved, some protected, others free or village forests. In the free forests hunting is allowed and the men take advantage of it. Hunting is usually a co-operative undertaking in Jaunsar-Bawar, for a number of men join together and take part in regular expeditions. The simplest way is to fence a plot of forest and men and women throw stones inside the fencing so that the animals may come out frightened attempting to escape. Stones are hurled from all directions and after some time the animals get exhausted and succumb to the injuries sustained during the onslaught. The other method is known as *Jibalu* and is ordinarily meant for the capture of panthers. These are greatly feared by the people. A cage-like device is made with stones and wooden planks and a goat is tied inside so that through the small opening which is automatically sealed should the panther enter the cage for the goat, the animal is captured alive. Most interesting accounts of methods of killing bears, are given by Khasas which figure also prominently in the folklores of the hill people. Curious beliefs about the nature and habits of the bear are found in Jaunsar-Bawar. A bear when it attacks men in the forests usually scratches the face of its victim and this, according to the Jaunsari, is due to its proverbial jealousy of the beauty of the human face. Though it is a dangerous animal, the hill people are by no means afraid of it.

Stories are current about the many indigenous methods of capturing bears. The bear, as a rule, attacks men from behind jumping on the back. One interesting method may thus be described though it appears highly improbable; two persons go out into the forest with two long baskets called *Ghildis* and sticks. The bear jumps on one but the latter so adjusts his *Ghildi* that the bear drops into it. The other man then belabours the animal

with his stick. To avenge this the bear jumps on the other man who also places his *Ghildi* in such a position that it is immediately trapped. The first man now strikes on the bear's head with his stick and between the two they kill the animal. This method of hunting bears, if it is practicable (which indeed is doubtful), shows that the hill people are careful observers and they know how to take advantage of the nature and habits of the animals with whom they share the forests.

Jaunsar-Bawar is a cold country. Though in the valleys of the Jumna, the Tons, and their feeders there is considerable heat from March to October, the winter is usually pleasant. On the higher altitudes, the thermometer sometimes records over 20 degrees of frost. The winter months are spent in feasts, and festivities by the people as no agriculture is possible on the hills. This is the time when the hill people kill their goats and feed their neighbours and for a month or more feasts continue and mutton and beer are all that they live for.

The Jaunsaris are very fond of building substantial houses. These are made of timber in beautiful surroundings with the small terraced fields below, and are picturesque in silhouette against the hillsides. The villages are usually situated in valleys or on the slopes of hills, but never on the top. Winter is very severe on the hilltops and continual snowfalls and severe cold blasts make living on the higher altitudes difficult and dangerous to the extreme. The need for warmth in such a climate makes the people extremely fond of the sun, and they build their houses in such a way that they get the maximum period of sunlight. Besides sunlight, water is precious in the hills, and the villages are built by the side of hill springs or on the banks of rivulets, so that water may be brought to the village by channelling it from higher levels.

A group of villages co-operate in distributing water to the villagers and definite schemes for apportioning water by the villages are carefully drawn and executed. These make it obligatory for a village to keep the channel within its boundary in good condition, to insist on the use of water by the village and also to co-operate with neighbouring villages in contributing labour for constructing or reconditioning the springs, reservoirs and channels on which supply of water to the entire group of villages depends. The small terraces available for cultivation are intensively treated as farming demands skilful manuring and irrigation in these regions. Water for irrigation is brought to the terraces sometimes from rivers and rivulets through small *kuls* or channels skilfully cut on the rocks. The usual method is to make a dam across a *gad* or river at a suitable place and from there the water is brought through a canal, one to three feet wide and one to two feet deep to a point at the highest level of the field. If a continuous channel cannot be made on account

of surface conditions, a *patnalū* connects the ends of a *khalū* or gap which is otherwise unbridgable.

Patnalū is made from the trunks of trees, by hollowing them lengthwise so that they may serve as channels for water. The construction and maintenance of *kuls* are often the concern of a group of villages so that they are either made by collective labour or by someone known to be expert in making them. In the latter case, the villagers have to contribute their respective shares towards the stipulated amount to be paid to the artisan or contractor concerned. The contribution of individual families is proportionate to their share in the village land, and is decided by the *Sayana* or headman of the village, or of a group of villages which are served by the *kul*. The maintenance of a *kul* during the months of July and August, when there is heavy rainfall in these parts, is a difficult job and the entire village or a group of villages has to take the work in hand. Though usually there is no quarrel among the villagers on these matters, for the authority of these headmen is still regarded as sacred by them, dissensions regarding the distribution of water are frequent. The headman with the assistance of the elders of the village has then to intervene and settle the disputes.

Another use made of *kul* in these parts is the running of *ghats* or grinding mills worked by waterpower. A *ghat* may be owned by an individual family or a group of families. If it is owned by a particular family its use by others is ungrudgingly allowed and custom demands that a small portion of the ground stuff be given to owner of the *ghat*, as his rightful share. There is nobody to receive it and it is usually kept in a basket or a leather bag, provided by the owner. The Khasas possess an extraordinary sense of right and wrong, of honesty and justice, and they seldom abuse this privilege.

The *ghat* is enclosed within a small rectangular thatched house or one made of timber and slates. The mechanical device is simple enough. As the mill is worked by waterpower, water must be brought down from higher level with sufficient force so that it may set the mill working. Water is brought from *gads* and is carried through a wooden channel known as *pandal* which is dug out of trunk of trees. The *ghat* is made of two round flat stones, one placed over the other, the lower one is the *tali*, the upper one is known as the *pat*, the *tali* is fixed on the floor with an iron nail running vertically through the centre of the *tali* over which the *pat* is placed. This pair of circular stones is connected with a wooden block called the *verum* with projecting flat sticks called *panwals*. It is so arranged that no sooner the running water rushes against the *panwal* the *verum* starts moving and there is a device by which it makes the *pat* move on its own axis—the iron nail. A wooden container wide at the mouth and narrow at the lower end is connected by means of a tubelike arrangement with the *pat*, so that with the rotation

of the latter grain put in the container pours through the narrow end of the tube into the mill which grinds the corn and releases the flour.

We have already said that the Jaunsaris build substantial houses. These are usually built of timber, mud, and slates. For timber they use *Deodar* and it is only the poor people who use inferior stuff. Iron is not very commonly used in these parts. The houses are rectangular in shape and consist of two or more storeys. Each storey has a single room and the height is just enough to allow a man to stand erect. As the average family possesses one house, if it is two-storeyed which it usually is, the ground floor is used to house the cattle so that all the members of the family have to share the only other room in the house. Several brothers with their common wife or wives sleep in this room, so that the total output of animal heat may serve the purpose of comfortable bed. Here also they cook their food, keep their belongings, and lounge during the day. Some families possess a *Kuthar* or small storehouse separately built in the yard, but as the levels of the two houses are not the same they are connected by an improvised staircase. There is not much scope for ventilation in the house except through the big door made of a single solid plank or two or more planks joined together so as to form one piece which can be fastened from inside as well as from outside by means of iron rings, and hinges. Besides the big door at the entrance, there may be one or two small windows in every room, which are like small holes and usually kept shut from inside the room. On the first floor there is a *Khadru* (wall almirah) three feet by one to two feet, which is used for keeping odd things and the small belongings of the family. The oven is inside the room. A big flat stone (*pathal*) is placed on the floor, and another at right angles to it, leaning against one of the walls, the stone is thickly plastered with mud, so that there is no chance of fire heating the stone so that it can set the wooden floor ablaze. The fire in the oven is kept smouldering day and night and is replenished with leaves and twigs as required from time to time so that the inmates of the house can get fire for tobacco and curl round it to keep the severe cold at bay. There are two to three mouths in the oven so that two or more pots may simultaneously be placed over it. A small hole in the roof covered by an adjustable piece of slate provides an escape for the smoke and also allows light to enter when necessary. There is a balcony around the upper storey known as *Chhajja*, made by projecting the wooden beams of the house on all sides and planking them over. There is a wooden railing round the balcony for the protection of the children. In the yard of the house, a small area is paved with flat stones which is used for drying grain and massaging and sunbathing which are popular recreations in these parts. As the people do not take frequent baths due to scarcity of water in the summer, and

intensity of cold in the winter, daily massage and application of oil on the body are regarded as essential for personal hygiene, and it is the wife's duty to oil and massage her husband or husbands. So used are the Khasas to this form of comfort that they regard this service from the wife as a husband's privilege.

The Khasas decorate their houses with carvings on the wooden walls and beams. These are very nicely executed and show unusual skill. The ends of beams which project out of the roof are artistically carved to resemble the faces of men and animals such as panthers, monkeys. Where two or more ends of beams meet the carving shows superb technique in depicting the faces of animals. On the walls of the houses, particularly the front wall of the main house, and the balcony of the *kuthar*, the carvings of flowers, animals, etc., are carefully made. Scenes depicting hunting and other activities of the people are also drawn on the sides of houses.

The front wall of the house is painted brown or light red, and the artistic mural decorations are given their proper colour, so that the houses in Jaunsar-Bawar appear to be attractively designed and substantially built. Old houses which have stood on hillsides for a century or more were all built of *Deodar*, but as the *Deodar* forests have been closed down by the administration, it is with great difficulty the rich among them can secure *Deodar* for building purposes. The poor people now use *Chir*.

The construction of houses is not usually the work of the family concerned. There are certain families known as Oad who are skilled in this work and these are usually employed by well-to-do families. The Oad is paid in kind; during the period he is engaged in the work, his family is fed by the employer and after the work is done, he receives some further reward in coin or kind or both. Every family which needs the services of an Oad has to pay some annual contribution (*dadwar*) to him after the harvests reach the threshing floor. When the house is ready for occupation the owner has to sacrifice a goat in the yard and the blood of the sacrificed animal is ceremoniously sprinkled round the house to propitiate the evil spirits so that the occupants may have nothing to fear from their wrath.

The Jaunsaris use clothes of indigenous make. In the winter they wear a *choli* or woollen *achkan* which reaches down to the knees and a *suntan* or *pyjama* to cover the legs. In the warm weather the *pyjama* is replaced by a piece of rag round the loins and the *choli* over it completes their dress. This is why the people of Jaunsar-Bawar are occasionally described as naked Aryans, because the legs and thighs are completely bare during the summer. For a belt they use a long piece of cloth which is wound round the waist many times. The usual head-dress is provided by a turned cap with the edges rolled up while their shoes are made of leather soles and woollen tops. Recent contacts with Chakrata have effected certain significant

changes in their dress, in pattern as well as in material, and men are found to wear coats and vests which they buy secondhand from dealers in Chakrata. The sizes and cut of the *choli* made locally have also undergone some modification.

The women have not changed their dress much, though there are Jaunsar belles who don jumpers and silk sarees made into skirts which they buy at fairs or in town. The women use a type of *choli* known as *ghundia* which is longer and its lower half is decorated with plaits and flaps. The upper part of *ghundia* resembles a jumper with or without sleeves. It has now become fashionable to don cotton clothes instead of woollen in summer. Women prefer to put on cotton and silk if they can afford to. As they do not spin cotton, most of the cotton clothes are imported from outside, but well-to-do families have planted cotton trees and the spinning of cotton is becoming popular in Jaunsar.

Dress and ornaments have so great a fascination for the women that frequent quarrels with husbands occur if the latter do not provide them with fancy articles of dress or ornaments. While in Gharwal and adjacent Simla States polyandry is being gradually replaced by marriage between single pairs, in Jaunsar-Bawar even a group of husbands often find it difficult to maintain a wife whose demands for clothes and finery are on the increase. Frequent quarrels arise when the wives complain against their husbands for incompetency to provide them with heavy ornaments, and divorce or *chhut* often arises from these complaints.

The usual ornaments worn by Jaunsar-Bawar belles are many and varied and the shape and size of these are different from those one finds on the persons of women in the plains. The majority of the ornaments worn in Jaunsar are meant for the ear, nose, and neck. Various kinds of necklaces are worn of which *Chharu*, *Jantar* and *Khagwali* are the most popular. The *Khagwali* is a thick flat necklet of one piece with the ends thinned out and tightly set round the neck. The *Chharu* is a bead necklace while the *Jantar* worn round the neck is made of flat pieces of silver, square or oblong and of various sizes. The most coveted ornaments are those for the ear called *Murkhula*, and the combined weight of these has the effect of dilating the lobes and elongating the ears. A number of these is usually worn by a woman and the whole ear is perforated to provide a base for these earrings. Often one finds a woman displaying earrings which she cannot hang from the ear, in a string put round the head. All the ornaments thus described are made of silver while the *Natholi* or the nose-ring is usually made of gold. This is a large ring thick at one end being inset with small silver or Munga beads. The thicker or heavier side is kept on top and is tied with a cord to the hair in such a way that it passes over the left cheek bone under the left eye. Besides these ornaments the

women also put on bangles usually known as *Dhagula* which are heavy and worn on the wrists. Men do not wear any ornaments but small earrings are often found on the persons of young men. Tattooing is popular today in Jaunsar-Bawar and women usually tattoo their arms, hand and feet. These are locally done by pricking the parts with a needle and injecting into the scratches a kind of vegetable dye.

General Economic Life

The main occupation in Jaunsar-Bawar is agriculture which the hill people have carried to perfection. The tiny terraces are carefully prepared and are richly manured with cattle excreta which their pastoral occupation freely provides, and water is skilfully brought to the terraces from distant springs, rivers or reservoirs. The land in Jaunsar-Bawar is of different quality and even the same village has lands of varying fertility. The nature of the hills is responsible for this variation in quality, for some hills are made of rock, others of soft earth, and the nature of the soil determines the fertility of the fields. Again land is divided into irrigated and unirrigated, the latter depending entirely on the rains and the moisture that can be preserved on the soil by preventing water from precipitation running out of the field. This is done by putting boundary walls of stones or by putting tree logs to prevent wastage of rain water.

A number of subsidiary occupations are followed in Jaunsar-Bawar, the chief being wool and ringal industries and the manufacture of articles of domestic and agricultural use. The cold climate of the hills makes it impossible for people to undertake any outdoor work during certain months of the year and in these months they necessarily follow occupations which can be pursued without much moving about.

Of the subsidiary occupations of the people, none is more important or more popular than spinning wool for domestic consumption. Every family has to spin wool for its own use and wool is spun by all the members, even by the small children. A small basket is carried about containing a small spindle and carded wool. Whenever their hands are free, they start spinning with their deft fingers. The wool is collected from the sheep and goats which every family in the hills keeps for its use. They graze on the uplands during the summer and in the winter they are brought back to the village. Twice in the year, once in the month of August and once in February the sheep are sheared. The average annual yield per sheep is about four pounds of wool. This raw wool is washed in hot water and kept under water for a couple of days. It is then beaten on stones to get rid of dirt and grease and finally washed. The wool is now dried in the sun and when completely dry, it has to go through a process of cleaning and carding with a bow-like implement called *chitkani*.

Though spinning is done by men and women in Jaunsar-Bawar, weaving is not a general occupation. It is done by low caste people, professional weavers. They are usually paid in kind or in coin, whichever the people can afford. Another subsidiary occupation is provided by the ringal industry which supplies the hill people with baskets and other containers for storing the agricultural produce of the family. These are locally made by the people from ringals (*Arundinaria* species), a light species of bamboo grown in some parts of the hills. Villages which do not possess ringal in the neighbourhood procure them from those where it is grown and a regular system of barter prevails between two or more villages. Ringal is usually bought by payment in grain. The people who sell ringal get it free from the forests and charge their labour to the buyers.

From the list of occupations we have described above, it will appear that the people have not much scope to supplement their income from agriculture. The hill economy is of self-sufficing type and the standard of living in the hills is not high. The few subsidiary occupations the hill people follow do not engage them throughout the year and much of the time is spent on feasts and festivities or in travels undertaken partly of necessity and partly in connection with the important festivals and pilgrimages. The little surplus they have of agricultural produce, they either sell to the shopkeepers in return for some of their pressing necessities, such as *gur*, salt, clothes and implements of agriculture. When the shopkeepers refuse to pay the price demanded the hill men have to walk long distances with their grain put in leather bags to be exchanged for necessities or for cash. Thus the cash they get by the sale of grain is not much, for it is limited by the quantity of grain they can conveniently dispose of. When they return home with the money they keep it for future emergencies or for paying *malgoozari*. Thus money does not circulate much in Jaunsar-Bawar. The presence of shopkeepers at different centres in Jaunsar-Bawar who are mostly immigrants from Dehra Dun, Saharanpur and far off places has made it possible for the villagers to exchange their products without undertaking long journeys but the price they get in return is not remunerative. The shopkeepers who receive the produce from the villagers do not always send it to town. There is a local demand for such commodities as labourers, *thikadars* or contractors and travellers require them and find it convenient to buy them from the shopkeepers.

The Jaunsaris are voracious eaters. They take food 3 to 4 times daily, and on festive occasions they are incredible gluttons. When they are full themselves, they are magnanimous to others as well and every householder entertains his neighbours and feed them on sheep which they keep in a room and fatten on oak leaves. Wine and meat are the most popular items of their diet and all castes including the Brahmin take meat; fish is not

always available but where it is, they are no less fond of it. They take pride in giving feasts and try to excel one another in providing rich and delicious menus. Ordinarily their breakfast consists of a heavy meal of *dalpuri* or fried *puris* stuffed with *dal*. The mid-day meal consists of cakes prepared from the flour of *Marsha* or *Cholai*; the third meal is of wheat bread taken before dusk and is usually light. Some families may take the third meal before going to bed. Rice, *dal* and *shikar* form the menu of this meal. The poorer families do not get so much to eat and they take inferior food. The coarser millets, leaves of Amaranth and wild vegetables form the simple food, while rice and *urad* are considered luxuries they can ill afford. Pigs and fowl are freely eaten by the lower castes, but even the higher castes have overcome their scruples against eating poultry which they often rear themselves.

The Khasas are extremely fond of drink; they brew their own liquor and drink it to excess. On the occasion of marriage and festivals, they booze day and night. Two kinds of indigenous drinks are locally made. One is called *daru* or *sur* which is a distilled liquor, another *pakin* or undistilled. A special kind of bread is required to prepare *daru* or *sur*. Four to five species of roots (pissar, berry, athu, pepper, etc.) are powdered in an *okhli* and the powder is mixed with flour. The mixture is kneaded with water and made into wet bread. The rolls of bread are arranged in layers with *bhang* leaves placed above and below each piece and are kept in a dry place for a couple of weeks or more. Later on, these rolls are put in the sun for further drying after which they are stored in the house for future use. This bread is known as *kim*.

The ordinary bread prepared from coarser millets which is the common food of the poorer classes is broken into pieces and put in a big spherical earthen vat with water, enough to cover them. The contents of this vat are daily stirred by the women till they completely dissolve in the water. The *kim* bread prepared by the process described above, is put in this solution and the liquid is kept aside for a week or so, being stirred every day as usual. When the liquid turns sour, which it does after a week or ten days, it is distilled through an indigenous apparatus. The distilled liquor is called *daru* and is used on ceremonial occasions, feasts and on festival days.

The other kind of drink is prepared out of the flour of *jhangora* (a kind of inferior millet) which is mixed with water and allowed to stand over for three months or more. After this period *kim* bread is added to the mixture and the contents stand for another fortnight or so. It is then strained and kept for the daily needs of the family. The precipitate is made into cakes and eaten by the people.

Elaborate methods of preparing food are found in Jaunsar-Bawar. Not only do the people take a large quantity of food,

they know also how to cater to the palate. There are more than a dozen varieties of bread made and each festival has its own kind. From the list of festivals in Jaunsar-Bawar it appears that many of these are associated with particular processes of preparing food and the distribution of the same to friends and relations forms the main function of many festivals. Besides the ordinary kinds of breads described above, they prepare a kind of bread known as *sira*. This is made in the month of *Pous* on the *Sira* or *Siriya* festival day. *Urad* and *masur* are soaked in water, the husks drop off and the soaked pulses are powdered and made into a paste with water. This paste forms the stuffing of bread and when the rolls are baked they become extremely delicious. Another delicious dish is prepared by roasting lumps of kneaded flour. These are wrapped in covers made of leaves put in the oven and when all the leaves have nearly been burnt in the process, the roasted mass inside the cover is ready for eating. Various kinds of *halwa* are also made. Barley meal or flour of millets and wheat is mixed with water and cooked with milk, *ghee* and *gur* or sugar. This preparation can be kept for a number of days as the whole thing becomes hard enough to stand the climate. *Puris* are usually prepared during festivals and they are sent as *samun* or presents to relations and friends. *Puris* are made in the way known all over India, but a special kind is also prepared by keeping the kneaded mass of flour under water for 24 hours or more. This variety has a peculiar flavour due to fermentation.

Though the ordinary diet of the Jaunsari is simple and does not display any great originality in preparation, the various dishes they make during festivals and ceremonies are rich in flavour and in *ghee*, and they take unusual care to see that their guests, friends and relations get the best entertainment possible. Every family keeps one or more sheep shut up in the goat pen from public gaze and fattened on oak leaves. For months, the sheep remains inside the room so that even the nearest neighbour may not know what is in store for him during the annual feast to which he is likely to be invited. Superstitious beliefs are also current among the hill people about the influence of the evil spirits, the evil eye and the evil mouth and this practice is said to guarantee the safety and growth of the animals confined in the pen.

We have described at some length the economic activities of the people, the methods by which they eke out their subsistence, the hardships attending their occupations, the rigours of the climate and the attempts of the people to get used to them. We have also indicated the means of exchange and distribution, the co-operative efforts willingly undertaken by the people for the common good of the village or a group of villages, the skilful devices with which they face nature and her niggardliness. We have also described incidentally their attitude to

life, to their friends and relations, to the environment in which they have grown up. The descriptive account given above may give an impression that life in the cis-Himalayas is not so full of hardships, but as we shall presently see the account we have given does not imply that the average Khasa family is well off economically.

As money does not circulate much in the hills, as the volume of exchange done by money is insignificant compared even to that obtainable in the rural parts in the plains, the standard of comforts enjoyed by them is not very high. The average family is inured to a hand-to-mouth existence and the expense on food and feasting is the only accountable use they make of their yield from the fields and of any supplementary income they may secure. The construction of shelters for the family and the decoration of their persons exhaust all the reserves they possess. As their resources are meagre, life is pretty hard for them in these cold regions. The gods they own are not always sympathetically disposed towards them, for reward is not proportional to effort. By tradition, their gods are known to be restless, like the palanquin in which they are ceremonially carried every year, turning this way and that, swaying to and fro. One year the Jaunsaris get a bumper yield from the fields, in another year they have nothing at all. Nature in these cold heights often conspires with the gods of their own make and shows her tooth and claw in the niggardliness of her favours. Yet the small terraces are carefully worked, water is brought from higher levels by ingenious devices and perfect husbandry of manure, water and rotation of crops is effected.

People have to keep cattle and sheep. The grazing of cattle and sheep on the slopes of the hills and on the higher altitudes keeps the men busy during the major part of the day; carrying dung and other manures from the grazing areas to the terraced fields is exacting labour; the shearing of wool, spinning and weaving have to be done by themselves, the marketing of produce and barter and exchange require co-operative effort while ceremonial undertakings and festivals require joint effort and voluntary subscriptions to the common pool. Thus life in Jaunsar-Bawar is full of hardships and had it not been for their joint family institution, the fate of the Jaunsaris would have been very much different as they themselves would tell you.

Social Structure

The social structure in Jaunsar-Bawar is characterized by a dual organization of economic classes, viz.: the Zemindars and the artisans. The latter, however, should not be confused with similar groups in the plains, for they are recruited mostly from the aboriginal substratum and mostly belong to a group known by the generic name of Dom. Whereas in the plains the artisan classes own land and when they do not, they have the

right of use, in Jaunsar-Bawar the local code forbids a Dom from holding land either as tenant or as Zemindar. On the lowest rung of the economic ladder, is the domestic Kolta who is the hereditary hewer of wood and drawer of water. He does not own any land, lives attached to his master, the Zemindar, and is given food and drink by his master. He lives in a house provided by his master and his expenses, if any, are borne by the latter. Anything other than food, and clothing, if provided by the family retaining him, is converted into a cash advance which he has to pay back should he wish to change his master or seek some other employment. The expenses of his marriage, of a death in his family, of any ornaments he wants to make for his wife and all that he spends at festival time or for propitiating the evil spirits and gods who meddle with his life and happiness, are borne by his master and the debts he owes on these accounts mount up till his future and that of his progeny are mortgaged indefinitely without any prospect of redemption. When he works in the village, he is given some bread in the morning and when he returns from the field in the afternoon, he gets either cooked rice or a measure of *chulai* or *marsha* out of which he prepares cakes. When he goes with the cattle for grazing on the hill slopes he has to remain for days there and his supply consists of the coarser millets such as *jhangora* or leaves of the Amaranth, which are boiled with lentils or a little rice. His house is within a reasonable distance from that of his master so that he may be available whenever required. If he is married, his wife has certain duties allotted to her and often has to drudge to earn her food.

Higher in rank are the *Lohars*, *Chamars*, *Odhs* or carpenters, who are requisitioned to serve the higher castes and whose remuneration depends on customary laws and not on the nature of the job or the demand for it. Next come the *Baggirs* (musicians), barbers and a few others whose right to hold land on their own account is not openly challenged by the Zemindars but who commonly live on the customary dole offered by the villagers and traditionally prescribed for them. The blacksmiths, for example, get sixteen seers of grain for each plough, shoemakers, sixteen seers for each man and eight seers for each woman and barbers five seers per head, paid twice in a year, at harvest time. In return for such gifts, these artisan classes serve the village by providing music on ceremonial occasions and doing other kinds of service as may be needed of them. Then come the Rawats who are of Rajput or Khasa origin. They hold land and also work as labourers in the forests and even go to Chakrata or Kalsi in search of employment. The Rawats in Jaunsar-Bawar are said to have immigrated in recent years and they are believed to be descendants of the Gharwali colonists.

The Rajputs form the most important numerous social group in these parts. They do not speak western Hindi which

is spoken by the people of the Dun district. Their language is called Jaunsari which is a dialect of the Central *Pahari*. The Brahmins are not of superior cultural stock nor have they maintained their endogamy. The *Gangaris* are the most numerous among the Brahmins. They are a regional group including as it does all the Brahmins who dwell by the Ganges river. They practise polyandry like the Rajputs and other castes of Jaunsar-Bawar and are called Zemindars. Where there are temples, as for example, in *Lakha*, they divide the duty of the priest's function of officiating in the temple among themselves and each family living in the neighbourhood gets a share of this duty by turn. Very few caste restrictions are observed as far as interdining or commensality is concerned, but where there is a village well, the Brahmin does not allow others to draw water or fill their pitchers or *gharas* from the well. The Brahmin comes at particular hours, and all those who want water get their vessels filled by the Brahmin. This duty of the Brahmins is also distributed among the families and in return for this service, the families who get it, offer some remuneration, in kind at harvest time. Another section of Brahmins in the hills are known as the *Sarolas* who occasionally emigrate from Jaunsar-Bawar and work as cooks in various parts. These observe certain rules regarding interdining and ceremonial purification and abjure meat and wine but they form a comparatively small group.

The territorial unit in Jaunsar-Bawar is the village. Each village has a headman or *Sayana* who is not the elected chief. Originally he was nominated by the *Sadar Sayana* but his office today has become hereditary and he is subordinate to the *Sadar Sayana*. Remnants of a feudal system are still discernible in the tenures of Jaunsar-Bawar. The *Sadar Sayana* who was in earlier days known as *Thokdar* is the overlord and is responsible for the management of the *Khat* or *Patti* and he represents his *Khat* in all its relations with the local administration. The *Khasas* are believed to be immigrants in Jaunsar-Bawar. They appear to have come in nomadic hordes each under a *Thokdar*. The families which constituted the nomadic group settled down in different villages but acknowledged the authority of the *Thokdar*. The villages, which remained under a *Thokdar*, were bound by certain obligations to the latter. His importance as leader of an immigrant horde was recognized by the villages and he received many services and dues from his party men in the shape of gifts and customary dues payable to him on important occasions and festivals. Each family had to give twelve days' free labour in a year to the *Thokdar*. When a child was born in a family, the *Thokdar* received a gift, when a girl was married, he received something; when a new house was built, he was offered a present by the family concerned. When a sheep was killed by a family, one leg was sent to him. In return

for these considerations or tributes, the *Thokdar* looked after the interest of the villagers in his *Khat* and organized defence against raiders, settled disputes as arbitrator and undertook to defend the rights and privileges of the families owning allegiance to him. To-day the *Sadar Sayana* or *Thokdar* does not wield much influence and the village *Sayana* has asserted himself and has secured greater rights and privileges than were enjoyed by his predecessors.

The village community consists of a group of proprietary cultivators, these are known as Zemindars. They are also called *Mauroosi* cultivators as opposed to *Gair Mauroosi* or under cultivators. The latter cannot alienate the land and are to all intents and purposes tenants. When they give up the land, it reverts to the proprietary body and when the Zemindars give up their own land, the co-owners exercise the right of pre-emption. The Zemindars are Khasas who cultivate their own holdings themselves with the help of a number of agricultural serfs called *Koltas* whom they maintain and who can demand to be maintained by them.

The political importance of the *Thokdar* was immense in earlier days and the control he exercised on the people of his *Khat* was a matter of great concern to the administration. In the native States where the system was more developed, political expediency necessitated the divesting of some of the rights and privileges of the *Thokdar*. Tactless handling of the situation led to trouble in some States but with the gradual tightening of central authority, the *Thokdar* lost much of his pristine status, and today he is not a force even in his own *Khat*. Bereft of his political authority, he is still an important link between the village headman and the administration and has been used to the advantage of the latter. With the weakening of the hold of the *Thokdar* or *Sadar Sayana* the *Khat Panchayet* consisting of the *Sayanas* of all the villages in the *Khat*, over which he presides, has lost its jurisdiction and influence and disputes between two villages are not usually referred to the *Khat Panchayet*, but are settled by the *Panchayets* of the two villages concerned.

The village *Panchayet* is a body of three to five persons presided over by the *Sayana* who is the *Sir Panch*. The elders who constitute the *Panchayet* are drawn from elderly men, selected for their tact and experience. Knowledge of men and matters, sojourn in foreign lands and experience as functionaries of the Government in some capacity or other, are some of the necessary qualifications for membership of the *Panchayet*. This organization is more or less permanent without any recognized constitution or procedure. Its proceedings are informal and it meets whenever there is an occasion to do so. The *Panchayet* acts as an arbitrator in disputes and its machinery is successfully utilized to organize periodical festivals, fix dates

of ceremonies, collect subscriptions for such purposes, look to the supply of water for the village and for irrigation, to supervise the morals of the villagers and to assist the village headman in the discharge of his duties and responsibilities. In one case, which was decided in our presence, a girl was betrothed to a young man by her father and the latter received a *Tando* or earnest money of Re.1. A few weeks later, there was an altercation between the bride's father and an uncle of the bridegroom-to-be, and the former called off the match and married his daughter to a third party. The *Panchayet* of the *Khat* was informed and the father of the girl was fined sixty rupees and was asked to give a feast to the aggrieved party, and the *Panchayet*. If a *Kolta*, *Chamar* or a member of an artisan caste is found to elope with the wife of a Rajput or a Brahmin, exemplary punishment is meted out to the man and anybody who harbours the couple or aids them is severely punished. A heavy fine or *har* is imposed by the *Panchayet* varying from Rs.125 to 300 or more, and this amount when realized from the offender is divided equally between the aggrieved husband and the members of the village. If the offender does not pay up, the couple must leave the country. If, however, the man who elopes with another man's wife can prove his previous intimacy with the girl, the amount of the fine is reduced considerably. When a person belonging to the higher castes seduces a woman of similar social status, he has to pay a fine of sixty rupees only. A low caste man who commits such a crime can be kept by a *Khatdar* on payment of a wergild. Crimes such as the theft of sheep, goats, etc., are usually dealt with by the *Panchayet* and if the culprit is traced, he is asked to make good the theft and pay a fine. In a case of theft in the village of Jadi, the thief who stole a goat was asked to pay back five goats of which two were given to the owner and the remaining three to the *Panchayet* and the village, who celebrated the occasion with a good feast. Whenever any partition of property is made by the *Panchayet*, the *Sayana* receives as his share, one sheep, one goat, one metal utensil, one weapon and five rupees. The *Panchayet* receives five rupees and the villagers two rupees but in the case of poor families, the fees are considerably reduced and sometimes no payment is made to anybody.

The Khasas are a patrilineal people with patrilineal inheritance and patronymic designation. Each village stands as a social unit and is usually exogamous. The joint family system prevails. A group of brothers live together with one, two, or more wives under the same roof, the brothers sharing the wives in common, without exclusive rights of cohabitation with any one wife. The eldest of a group of brothers wields a dominating influence in the domestic affairs of the family, he is the social as well as the ceremonial head of the family. It is to him the other brothers have to turn for advice and guidance.

He determines the duties of the brothers, provides the necessities of the family, and the rest of the brothers have to obey him, and to hand over to him their individual earnings. If a brother wants to marry any particular girl of his choice, the eldest brother goes through the ceremony of marriage with the girl and he may assign the bride to the particular brother concerned. If there is a dispute between two brothers and it may occur on account of rivalry and jealousy between them, the eldest brother arbitrates and his decision is final. If he asks the common wife not to bestow her favours on any of the brothers, the aggrieved brother has no appeal to any higher body in the village. Society upholds the dignity of the eldest brother. The alternative is chaos which the society dare not encourage. The children of the joint family of a group of brothers are maintained by the family and paternity is decided by a useful convention. The eldest born child is fathered upon the eldest brother, and the next child on the second and so on. In case of a dispute between brothers, which may arise when one of the fathers wants to live apart and start a new establishment, the joint wife may be asked to name the fathers of her children—alternately the husbands of the joint wife may draw lots to determine paternity of children born to the family. If four brothers have one wife between them and four or five children are born, and one of the younger brothers marries again, the children usually remain with the woman and the latter is not allowed to go to the younger brother. She must live with the other brothers but the children are entitled to equal shares from all the brothers including the youngest. If the other brothers wish to separate, the eldest brother has to bear the expenses of their marriage as well.

Customary laws in Jaunsar-Bawar make the eldest brother receive the lion's share of the property when partition takes place. According to the laws of inheritance in force, property is divided in the following manner:—After deducting one thing of each kind and one field for *pitans* or *jethong*, viz., on account of seniority, and half of that field, viz., *kanchoo*, for the youngest, the rest is divided equally among them. The family house in Jaunsar-Bawar apparently belongs to the eldest brother, the crops are his, the cattle and sheep are owned by him and the wife and children and their maintenance and control are his. He is the governor of the family and his brothers accept his rule and authority without a grumble. Cases have been found when a younger brother has rebelled against this social and economic monopoly, has forced the elder brother to a partition of the family property, or to the granting of exclusive right of cohabitation with a particular wife, but to the extent he gains individual rights, he loses social prestige and very often his wife deserts him afterwards. It may sound strange to a capitalistic society, but it is a fact that if a man happens to be the only son of his

parents, he stands little chance of securing or keeping a wife, for a wife would not care to live with one man as she would have to do much work for the family. He must, therefore, find out his cousins or collaterals before he decides to marry and settle down.

The custom which allows such a privileged position to the eldest brother has no little influence on the familial relations in these parts, and it is no wonder that the eldest brother wields such great authority in the domestic economy of Jaunsar-Bawar. Complaints against the behaviour of the eldest brother are infrequent and if they arise, they are not viewed with equanimity by the village elders. The individuality of the members in a joint family is thus circumscribed by the traditional loyalty to the head of the family, demanded of them. Besides this attitude of loyalty to the eldest brother, there are other considerations which make partition of property extremely uneconomic as we have already referred to.

Cultural Life

The culture of the Khasas of Jaunsar-Bawar has been deeply impressed by their contacts with the Doms or the aboriginal element in the population. The Doms belong mostly to the Austric race and their cultural life greatly resembles that of the various tribes of Pre-Dravidian or Australoid origin. While the Khasas claim to be Hindus and recently they have been fast adopting Hindu surnames and trying to establish connection with the Rajputs and Brahmins of the plains (their contacts with the outsiders have taught them the importance of their claims), their social life as well as their beliefs and practices connected with their religion do not identify them with the Hindus of the plains. They remarry widows, practise levirate, sororate and polyandry, recognize divorce as legal, while intermarriage between the various Khasa groups is not tabooed and children born of such marriages do not suffer any social stigma. While they worship Hindu gods and goddesses, they have a partiality for ancestor spirits, queer and fantastic demons and gods and for the worship of stones, weapons, dyed rags and symbols. On the other hand, their customary rites in the temples, the manner and mode of offering sacrifices the daily religious performances in the temples, the dim lighting, the burning of incense, the mysterious incantations and sing song monologues, all indicate Hindu origin, tradition in ritual and temple worship.

The sun, the moon and the constellations are their gods. The sun is male and the moon female. The moon's pride on account of her greater beauty and her insulting behaviour towards the sun on that score, provoked the latter's wrath and his curse had the effect of disfiguring the moon's face resulting in spots which are said to be marks of leprosy to which the people are often victims. The Hindu belief that the earth rests

on the head of a snake, *Sheshnag*, finds its counterpart in Jaunsar-Bawar and earthquakes are believed to be caused by the periodical movements of the giant snake. The Mundas believe that eclipses of the sun or moon occur when their creditors surround the sun or moon for the debts of the Mundas and this represents the typical belief about eclipse among all the Austric-speaking tribes in India. Among the Khasas, the sun and moon are said to have borrowed money from a Dom, but the interest swelled to such an amount that it could not be paid and the debt was repudiated. The Dom on that account worries them often by throwing a skin on their face. Though the average Khasa is always in debts, the stigma attaching to persons of higher castes who borrow from the Dom is great in Jaunsar-Bawar, and the elders belonging to the higher castes do not tolerate such practices in the village. The customary raising of *menhirs* and other stone memorials among the Khasas appears to be a relic of a megalithic cult which is an important phase of Austric culture. The Khasiyas appear to have in all probability, borrowed this custom from the aboriginal element in these parts. It is customary to construct a terraced platform near a public thoroughfare on which they place a single upright stone to commemorate the dead.

The belief in the transmigration of souls and in the doctrine of metempsychosis is an important feature of their religious life; they believe that the soul has to pass through as many as 84 lakhs of forms including animals and insects and the activities of man on earth are carefully recorded by *Yama* whose messengers have to present the souls before him. As *Dharmraj*, *Yama* determines the form which a particular soul should pass into, in accordance with its activities on earth.

Their religion is a curious blend of Hindu and tribal beliefs and practices and a functional analysis of these is sure to provide interesting materials. Nowhere perhaps are magic and religion so closely interlaced and interwoven as in Jaunsar-Bawar. Magic plays an important rôle in the life of the hill people by giving them confidence in danger and crisis, and by providing the incentive to organized undertakings. Not only in the main occupations of the people like agriculture and lumbering, in ordinary day to day life, magic is potent and effective. The importance of the evil eye and the evil tongue is recognized by the hill people and oaths and ordeals have a significance hardly paralleled in savage society. It is possible to effect injury to person or to cattle or both by magical practices, to cause death in a family by mere swearing as they believe, and to cause houses to be burnt by magic. The courts of justice recognize the importance of oaths and ordeals and when the necessary evidence in a civil case is not forthcoming the parties are allowed to decide the issue by means of oaths and ordeals. In some cases, the defendant in a money suit will keep the sum of money

before the image of the goddess *Kali* or in any temple dedicated to *Mahasu* their great god and the plaintiff is asked to take the money. Should the defendant want to prove that the money he owes has been paid by him, he drinks the water in which the feet of the *Devata* are dipped and this is taken as evidence to the effect that the money has been paid by the defendant. In other cases, the plaintiff will light a lamp in a temple and the defendant has to put it out proving thereby that he has paid the amount due from him. If a villager bears a grudge against his neighbour and he wants to harm him or his effects, he takes a clod from his field and lays it on the altar of *Mahasu*, and prays for an immediate judgment. Should this neighbour meet with any accident or domestic trouble, he would leave his field as otherwise the god invoked by his enemy may cause greater calamity to befall on him. The consequence of dishonesty and false statement on oath is terrible as the person is sure to be affected with insanity or leprosy, or some great calamity may occur in his family, or he may die an unnatural death within a short period from the commission of the offence.

People who are notorious for their wickedness are supposed to possess some power either inherent in them or derivatively acquired. For example, they are known to abuse people and swear against them on the slightest or no pretext and the belief is that such persons can do harm as their *Ghat* or swearing is usually very effective. There are certain gods whom wicked and antisocial people usually invoke to effect their nefarious designs on others. One such evil spirit is *Narsin* who is extremely mischievous and is readily invoked to harm or destroy cattle and crops and to afflict people with diseases. The *Baki* or diviner has to get in touch with this spirit and propitiate it whenever it is suspected of evil. Though it is a criminal offence in Jaunsar-Bawar to call any person a 'witch', it is common knowledge in these parts that witches exist, and whenever any person meets with any misfortune or contracts any serious illness, the members of his family may suspect any woman, young or old, to be responsible for it and she is dubbed a witch. Henceforward, she becomes an object of close attention in the villages and her family is branded as antisocial and consequently segregated from the other families in the village.

The incidence of infant mortality is pretty high in Jaunsar-Bawar, and it is traced to the influence of certain evil spirits. These are always after children and women in the family way and their attention is followed by disease and death to their victims. There are people specially versed in spirit-lore who utter magic words and blow ashes over the child or woman believed to be affected by spirits and this is considered potent enough to cure the affliction. When a pregnant woman falls ill, it is believed to be due to the mischief caused by certain evil spirits and the woman has to undergo a course of treatment

prescribed by the *Baki* or *Ghādiala* (witch-doctor). With her hair dishevelled and forehead painted lavishly with vermilion she is made to sit near the witch-doctor. The latter takes a bell-metal plate in his hand and starts beating it to tune, uttering simultaneously a number of incantations in a peculiar singsong tune. After half an hour or so, the woman feels heavy, starts shivering indicating thereby that the spirit has entered her person. The woman shows signs of greater animation and moves her limbs to and fro, attempting to rise on her toes and eventually starts dancing to tune of the bell-metal music. Soon she forgets herself, her husbands and relations, and is metamorphosed as it were into the spirit which has taken possession of her. The *Ghādiala* addresses the spirit in the woman and the latter answers on behalf of the spirit. The source of the attack, the name of the spirit, the necessary offerings and sacrifices that would please it and any particular direction as to the manner and mode of disposal of the offerings are mentioned by the possessed woman and it is believed that as soon as these are offered as directed, the woman gets rid of the spirit possessing her. The spirit, however, leaves the victim in a spectacular manner. The woman shrieks, or strikes herself with some stick, or makes violent attempts at escape and is often forcibly brought to rest by the people present. This and similar practices show the extent of the influence of tribal beliefs and practices on the cultural life of the Khasas.

When epidemics invade a village, the resources of the village are freely requisitioned by the headman concerned and custom prescribes an *Astabali* or sacrifice of eight lives to appease the godling of disease. Five different approaches of the village are selected for the purpose and at each approach an improvised gate of bamboos is made. At the centre of each gate is fixed the wooden effigy of a monkey and a vertical slab of stone or menhir is firmly fixed in the earth. The menhir is crowned with a large round stone and two pieces of wood with flattened ends are tied on either side of the upright slab, the whole resembling a human figure from a distance. Five different sacrifices are offered at the five approaches to the village. At one, a goat is killed and buried near the menhir, at the second place a sheep is similarly sacrificed and buried. A hen, and a pig are sacrificed at the third and fourth approaches respectively, while at the fifth, they cut a pumpkin into two halves and bury it likewise. After the sacrifices at the selected places, the villagers all assemble in the yard of the temple where a sheep and a vegetable (*Gindoro*) are offered as sacrifice. The *Gindoro* is cut into pieces and the sheep is killed and given to the Doms. A goat is sacrificed in the name of the village and the meat is distributed among the villagers. The elaborate rites of *Astabali* are performed only when a major calamity is feared and the efficacy of this prescription is seldom questioned by the villagers. The village priest

is in charge of this sacrifice and he cites hymns and prayers as well as magical incantations to invoke the aid of the gods.

They do not appear to be much concerned with rewards and punishments in the world to come but they observe a code of conduct which, if followed, is believed to pave the way to a prosperous life in this world and uninterrupted bliss in the next. These refer to their food, sleep and sacrifice. They must not drink pure milk and they should abstain if possible from butter as it may better be burnt in the temple of the gods. It is on ceremonial occasions and festivals that they may eat butter after it is dedicated to the gods as offering. They should offer the best sheep or goat to their gods as sacrifice and they should not sleep on beds with four legs, usual practice in Jaunsar-Bawar is to sleep on the wooden floor.

The principal occupations are safeguarded against interference by the forces of evil which people their imagination by a system of protective and productive magic. It is true that the efficacy of these magical rites is being minimized by the people but this has not caused any serious challenge to the traditional code of conduct so far as it relates to the observance of rites of protective magic. Magic embraces practically all spheres of activity. When they build a new house, they have to protect it from destruction by fire, or from calamities that may fall on the inmates, and the usual practice is to sacrifice a goat or sheep to the evil spirits and the blood is sprinkled round the house. When the bridegroom comes back home with the bride, before the couple is allowed to enter the house, some relative, usually the maternal uncle, throws down from the roof of the house a live sheep in front of the couple below. The relatives and friends of the couple tear pieces of flesh and bone from the animal and there is a scramble among them for the heart and liver of the sheep—which when eaten raw, ensures good luck to the eater. The bride and the bridegroom are then allowed to get inside the house.

When the harvest are brought home or the first sowing takes place, the evil spirits are propitiated by individual families while a common sacrifice is made by the village to undo the evils of magic. Human sacrifice is non-existent, but the efficacy of it in theory is not denied by the Khasas. The custom of rope dancing which formed an important annual festival in these parts has become obsolete as it has been forbidden by the administration on account of the risk to life involved in the process, but in times of agricultural calamities occasioned by the vagaries of rainfall or by insect pests and diseases to crops and cattle, they remember the olden days when the annual *Bedwart* (rope dancing) provided the necessary safeguards against such supernatural visitations. Even today in Rawain, a neighbouring State, *Bedwart* is allowed to be practised under

police surveillance as the people have made repeated representations to the State authorities not to interfere with the age-old magico-religious practice. The failure of rains and harvest they trace to the non-observance of their magico-religious practices and the State had to yield to their persistent demands. The *Bedwart*, as was practised in earlier days, was a cruel custom as it subjected the *Beda* or dancer to physical violence. Originally, a lengthy piece of rope stoutly made was tied to two peaks of unequal height and the rope was greased for days and weeks to allow the *Beda* to slide smoothly from the higher to the lower end of the rope. The *Beda* after a ceremonial bath, was seated at the highest end of the rope and was given a push and the greasy rope did the rest. The *Beda* glided down the rope at a terrific speed, somehow clinging to it, and the vast crowd gathered to watch the ceremony broke into loud cheers as the *Beda* approached the end of the lower peak. If the *Beda* accidentally missed his hold of the rope, it was fatal for him, for he would certainly dash against the ravines hundreds of feet below and be shattered into fragments. If he succeeds, as he usually does because it is undertaken after long preparation and practice, he loses his hold of the rope immediately before he reaches the other end, and drops down into the arms of a receptive crowd who carry him on their heads and move with him through the crowd. The piece of cloth or rag he puts on is torn to shreds by the crowd and each man keeps a thread or two from this cloth as protection against natural calamities and as a sign of good luck and prosperity. In the scuffle that ensues to secure this luck, the *Beda* loses not only his cloth but even tufts of hair from his head and may receive even serious injuries. Other magico-religious rites include naked dances before sowing, during the growth of the crops and after harvests. Playing with red hot iron rods, swallowing burning charcoal and such other ordeals are some of the other precautions designed to safeguard their material prosperity and domestic bliss.

The Family

The typical Khasa family consisting of a group of brothers as husbands with one, two or more wives and children represents a social and not a biological group. The father is not the physiological father but functional in the sense that children address him by his functional name as for example, father-who-looks-after-the-house, father-who-tends-the-sheep, father-who-grazes-cattle and so on. The close tie between the child and mother that we get in a stable monogamian family cannot develop in a polyandrous society of the type we get in Jaunsar-Bawar. The frequency of the practice of *Chhut* or divorce makes the wife a loose unit in the family and she changes her affiliation pretty freely. The care and maintenance of the children therefore devolves on the group of fathers, particularly

on the head of the family and it is the duty of the latter to see that the children get the proper attention and necessary instruction in the formative years. The mother has to perform her duties and comply with the obligations of motherhood so long she remains a member of the family and conforms to the rules of residence customary with patrilocal groups. But as she migrates periodically to her parent's village at harvest time and during the festivals, the children do not get her company throughout the year. The normal socio-psychological association between mother and child cannot develop on account of frequent interruptions by these voluntary migrations. The novel situations arising out of customary participation of the people in fairs and festivals, the variety of interests they stimulate and the scope they provide for satisfying the genuine curiosities of children lose much of their significance in shaping the mother-child relationship. The importance of these casual migrations of young married women to their parents' village will be realized when it is known that in the villages we investigated most of the married women between the ages of 15 to 35 were absent and women of the same age group belonging to the village but married in other villages replaced them as domestic help and farm hands during the harvesting season. Women above 35 and those whose psycho-sexual life has lost its intensity of exuberance and women who are sick or diseased do not move from the village and they with the girls of the family manage the household and care for the children. This seasonal interchange of women between villages has a number of advantages for a polyandrous community. Firstly, it allows a release of tension in sexual life for with the return of the girls of the village to their parents' house and the absence of the wife or wives from the village, opportunities for extra-marital relationship increase and intrigues within the village are possible without a disturbance of normal wedded life. Secondly, the periodical return of the girls of the family reduces the instability of the family relationship in the event of wives leaving the family permanently, and ensures continuity of economic existence of the family. Thirdly, the seasonal residence of the wife in the husband's house and periodical migration to her parents, the knowledge of the two standards of morality enjoyed by women in Jaunsar-Bawar, and the possibility of easy *Chhut* while reducing the sanctity of marital obligations also temper marital jealousy.

In a polyandrous society, in order that social life may run smoothly, marital jealousy must be absent, and this is so in fact, we are told by competent authorities. It is true that when several brothers share one wife the brothers must not quarrel over her, and custom and tradition determine the attitude of the brothers to one another and to the wife. The importance of the eldest brother or *Jeth* among the Khasas generally and in Jaunsar-Bawar particularly has greatly minimized marital

jealousy as it is not usually possible for the other brothers to possess the wife sexually so long the eldest brother resides in the house. In practice, however, the eldest brother does not exercise this sexual monopoly and his frequent absence from the house provides the necessary transference of sexual rights to the next of the brothers. Besides, the disparity in the age of the brothers makes it possible for the elder brothers to secure to themselves the right of cohabitation till the younger brothers come of age and in ninety cases out of a hundred, a second wife is taken in the interest of the younger brothers. But jealousy between brothers for the affection of a common wife is not rare and manifests itself in the demand by the husband concerned for better attention to his needs and comforts. In such cases, the wife, if she is clever, manages her obligations to the satisfaction of the husbands concerned. If she does not, quarrels do take place and the eldest brother may order a dissolution of the marriage. While quarrels between brothers are obviated by customary rules of conduct as described above, those between co-wives are of frequent occurrence. Unless the second wife happens to be the sister of the first as is very often the case or someone in whose selection the first wife had a voice, no second wife can be taken while the first remains in the house. She must be divorced before another wife can be brought in. Thus the wife's sister is normally preferred to others as a second wife in Jaunsar-Bawar. When they get a second wife, precautions are taken to see that quarrels between co-wives may not occur too often and magical rites have been introduced to remove the shadow of misunderstanding. When a second wife other than the sister of the first one is taken, an interesting ceremony is gone through. The second wife is made to sit in one corner of the room, the first wife sitting opposite to her while an elderly woman with a lighted *dip* in her hand stands by each of them. Another woman stands in the centre of the room and joins their hands and each gives the other a silver coin. The *dip* is held in such a way that the shadow of the one does not fall on the person of the other.

Marital Life

Marriage in Jaunsar-Bawar takes place early in life. Between the ages of 2 to 10 years most of the girls are married, though this does not mean that cohabitation follows earlier than in the plains. From the cases we have noticed of girls proceeding to their husband's village for residence for the first time, it does not appear that the girls have to do so before they are seventeen or eighteen and this is a fair arrangement as puberty sets in later in a cold climate. Occasionally, however, a girl of 8 or 10 may come to live with her mother-in-law for a couple of months or so and assist her in her domestic obligations, but such residence has not been abused by the husband or group of husbands.

Besides in the case of a first marriage, the bridegroom also is of tender age and the possibility of an earlier consummation of marriage is remote.

When a son is to be married, the father approaches the girls' parents and asks for the girl. If the father or guardian of the girl satisfies himself as to the suitability of the marriage, he may demand the nominal bride price which is usually one rupee. The Pahari Brahmin then decides the date of marriage. On the appointed day 2 to 8 persons from the bridegroom's village come to the bride's house and are cordially received by the bride's people. The party is entertained to a sumptuous feast and the villagers get up a dance in which the party from the bridegroom's village take part. Next morning a hundred to two hundred persons proceed with the bride to the bridegroom's house singing and dancing all the way till they reach the outskirts of the village, their destination. All the villagers, men, women and children, assemble there to receive the guests and lead them to the bridegroom's house where they take care of their guests. A heavy menu at dinner with a large quantity of liquor served before and after the meal, a gala dance in which people from both sides take part, continuous singing by the women, the tom tom of drums, on either side, and sometimes a hunting excursion to the forest nearby, all make the ceremony a memorable event. Poor people cannot entertain their guests on such a large scale and the people who participate in the function from the village of the bride as well as those from their own village provide the necessary assistance for the family concerned in the shape of gifts which consist of rice, flour, *ghee*, *gur* and sheep or goats.

In the case of poor families, however, it is not possible to invite every villager to the feast. So one person of each family is invited to join the festivities and to give the ceremony a representative character. Even then the village acts as host and all the necessary arrangements are made by the villagers whether they are invited to the feast or not.

The ceremony of marriage is extremely simple. The Pahari Brahmin puts a *Tilak* of *Pithain* or vermilion on the forehead of the bride in the bridegroom's house and on the bridegroom's forehead in the house of the bride. He also cites some *mantrams* in the presence of the couple while he may, if he is asked, sacrifice a goat in honour of the great god, Mahasu, to whom he prays for prosperity and happiness for the couple. Before the food is sent to the guests, a plate of it is offered by the priest to the village god. This is obligatory on all occasions of feasts and festivals in the village.

Besides the ceremonial gifts of a rupee, the bridegroom's people may and very often do pay a small sum to cover the expenses of the bride's parents. Where the financial and social status of the parties differs, as for example, when the bridegroom

is not well-to-do and the bride's parents are, or when both the parties are well off, the bridegroom has to pay some money as bride price. But this amount need not be paid all at once. Half the amount is payable before marriage and the other half after the woman has proved her fertility. This amount is not paid if the woman after marriage proves barren. Barrenness is a frequent complaint in these parts and a husband who has paid a big sum as *Jeodhan* and has spent more on entertaining his friends and relations must be given some relief. Should the woman prove sterile, the bride's parents have to refund the other half of the dowry, and also have to receive the girl back if need be. A reasonable period after cohabitation starts is allowed to the wife to prove her fertility and if she fails to do so, she is returned to her parents and the necessary *Chhut* or divorce is obtained. Besides the fertility question, there is another practical implication of this custom, i.e. paying half the bride price and retaining the other half to be paid when the girl becomes a mother. The girl is married at the age of 3 or 4. When she grows up she becomes an economic asset. The father is reluctant to send the daughter away to her husband's village. He does not mind her licence in sexual matters so long as this is confined to the village. Intrigues with persons belonging to the same clan are not encouraged but there is not much restriction as regards those belonging to other than the clan of the girl. When the husband finds that she does not want to come to live with him, he demands repayment of bride price he has paid; of course, he takes this final step after he has tried his utmost to persuade the wife's people, for even if he has made a small cash payment he has spent a lot in kind and in entertainment.

The girl's father does not worry himself much about this demand, for if the girl is handsome-looking, she is sure to be demanded by another party who will pay the dowry back to the first husband and some amount to him as well. Whether he keeps the girl at his house or marries her a second time, he is a gainer in either case and these considerations have something to do with the many cases of *Chhut* and of strained relations between different villages. Where the girl is not handsome or does not receive proper care and indulgence in the parents' house, the parents do not prevent her going to her husband's house, for, in that case, they do not get willing assistance from her and lose the part of the dowry payable by the husband. Where there is no difference in status between the parties to a marriage, the girl is not withheld from the bridegroom's people, for unless she resides at her husband's place, she is not expected to fulfil the rôle of mother which alone entitles the bride's parents to receive the other half of the bride price. Girls even after their marriage come back to the village of their parents to assist them in field work during the harvest season and the sex licence that obtains in Jaunsar-Bawar during the festivals when even married girls

misbehave is understandable on this account. In the village of her husbands, adultery is a crime of the gravest magnitude and a wife guilty of such offence pays the penalty in no uncertain way. If she still remains in her husband's house, she is ill-treated by the family and is denied any sympathy by the village. This raises the question of morality in Jaunsar-Bawar. A woman has two standards of morality to conform to, one in her parents' house, one in her husbands'. In her parents' house she is allowed every kind of liberty and licence and nothing is an offence unless specifically prohibited. In case any child is born out of extra-marital relationship, the husbands concerned have to own it and this they do without much heart searching on account of the small number of children among the Khasas. Usually, the child is fathered on the eldest of the husbands of the woman. It was customary in earlier days, and even today it is in the interior, for girls (conforming to the social etiquette of the family) to offer themselves as bed-mates to guests of the family who may have no scruples in this matter. The rules of hospitality allow that grown up daughters of the family, married or unmarried, should cater to the comforts of visitors in every way. But a married girl in her husbands' house must observe strictly the rules of morality, must behave properly, must be faithful and loyal to the group of husbands and strict vigilance is kept on her movements by the family group as well as the village. Everything she does is considered an offence unless specifically permitted. But a wife in one village is a daughter in another and custom allows the wife to go to her parents' village where she may take advantage of this double standard of morality.

The usual explanation offered by the Khasas is found in popular sayings and proverbs which compare a girl after marriage to the carcase of an animal, so that the parents can have no interest in her after her marriage. She lives, they say, for the family of her husbands where her economic contribution is indispensable and thus her morals are no concern of her parents. How far this attitude is born of an original disgust at the transference of allegiance of the girls of a matriarchal society to a patriarchal is an interesting theme for discussion. We shall deal with this aspect later on.

Girls in Jaunsar-Bawar, as we have already pointed above, are married very early. But if the family suffers from some social stigma, or is known to have some hereditary disease, if the gods are known to have been displeased with the family, if some natural calamities had fallen on the family which could be traced to the wrath of the gods, or if the girls of the family are known to have broken faith by not going to live with the husband or husbands, it may happen that suitable proposals for marriage will not be forthcoming and the parents or brothers of the girl have to wait indefinitely for her marriage. A few such cases came to our knowledge during our investigations.

Some examples of polyandry in practice will be of interest in this connection. Hariram, *Sadar Sayana* of village Jadi, has four brothers, the youngest of whom Nain Singh is about 35 years of age. He with his brothers owns 9 acres, 3 roods, and 5 poles of land, 14 cattle and 88 sheep and pays Rs.8 as *malgoozari*. He is therefore quite a man of substance and the richest farmer in the village. Hariram married Gongga and paid Rs.60 as bride price. She proved barren and after 4 years, she was divorced and Hariram got back Rs.20 from her next husband. He married Jimuti, a divorced woman for whom he had to pay Rs.20 as bride price. Jimuti was found to be suffering from sexual disease and was divorced without any demand of part of the dowry. He then married Ashadi and paid Rs.50; she was also a divorced woman but after a couple of years, she died without any issue. The fourth marriage was with Pirudi for whom he paid only Rs.12. Pirudi is living with the family and has three children. Bipu is his fifth wife and has one son. Last year Hariram married Pusuli for whom he had to pay Rs.120 as dowry. She was divorced thrice before she was married by Hariram and has not any issue yet. Thus Hariram has married six wives one after another and between 4 brothers they have four sons.

Narayan, son of Hariram (for he is the eldest of the sons and thus was fathered upon Hariram), lives with his brothers and has married 3 wives. For the first wife Nagu he paid Rs.12 but Nagu died without issue. His second wife was Bardai who also was paid Rs.12 as bride price. She gave birth to two daughters but was later on divorced. The third wife, Chakeri was paid a dowry of Rs.120 as she was married after her second divorce. She has two sons living. Narayan's eldest daughter was first married to Jowar Singh who paid Re.1 as bride price but Pusu was divorced and the second husband had to pay Rs.240 to Jowar Singh as compensation.

Madan Singh has two brothers, Narayan and Ajmeru. He with his brothers possesses 4 acres, 1 rood and 30 poles of land, 8 cows and 44 sheep and pays a *malgoozari* of Rs.5-14. Madan paid Rs.2 as bride price and married Bardai and has 4 children by her. For the next wife he paid Rs.12 but after two years he divorced her and realized Rs.60 from the husband she married later. The third wife, Asuji had to be paid Rs.12 but she also was divorced after a year and fetched Rs.100. The fourth wife of Madan, Jamni, for whom he paid Rs.12 has no issue yet. Thus in this family 3 brothers have married 4 wives and have 4 children between them.

Amar Singh with his 4 brothers has married three wives. For the first wife, he paid Rs.50 as she was a divorced woman. After a year she was again divorced by Amar Singh and the latter received back only Rs.8. Next he married Jhani and paid Rs.10 as dowry. She also was divorced after a couple of years

and he realized Rs.8 from her next husband. The third wife is Rutu who is living with the brothers and for whom he paid Rs.50. They have a son by the present wife. Amar Singh with his brothers owns 2 acres, 1 rood and 26 poles of land, 10 cattle and 36 sheep and pays a fairly high *malgoozari* too. Thus in this family 3 brothers have one son.

Instances like these can be multiplied to show the rate of bride price, the frequency of *Reet* which combines in one transaction divorce as well as second marriage, and the number of wives and children per family. It appears from our investigation in Jaunsar-Bawar that usually the number of marriages is no indication of the plurality of wives for seldom has a family more than two wives simultaneously living together with the group of brothers as husbands. The marriages are usually in succession after the death of wife or after a *Chhut*. A *Chhut* is usually followed by another marriage. Further, the number of children in a polyandrous society is very low, for 4 to 5 brothers between them possess 3 to 4 children and sometimes less. Another fact which is extremely significant is the number of barren women. A husband waits 2 to 3 years to see if the wife provides any issue. If she fails, she feels that she is not much wanted in the family and thus she seeks a new home. If she is not wanted in the house, if she is lazy, or suffers from some form of sexual disease which is fairly common, or if she is guilty of some grave misdemeanour, such as her unwillingness to cohabit with the eldest husband, so long as he remains in the house, she is divorced and the next husband of the woman has not to pay any big sum as dowry for her. But if she wants to leave her husband herself and if she does not suffer from any disease or has already proved her fertility, the husband usually demands an exorbitant price from her fiancé, and this amount must be paid by the latter if he wishes to marry her. In such a case the larger the number of *Chhuts* a woman goes through, the higher the bride price she fetches, for the bride price must provide for compensation to the previous husband and his family.

It is easy to marry a girl of 10 to 12 years and one need not pay any but a nominal bride price, but a woman, who has been divorced thrice or four times, fetches a handsome dowry. A woman of 45 in Bangar village, with 4 *Chhuts* to her credit, was married by her fifth husband on payment of Rs.285 which may sound ridiculous when a girl of 15 or 20 can be married on payment of Rs.20 to 30 only. Investigations have shown that this woman has given one or two issues to every family she was affiliated to by marriage, and as children are very much desired by the people, a woman who has proved her fertility is at a premium. Considering the number of barren women, a woman who gives evidence of her fertility in one family is desired by others so that she chooses to change her husbands whenever opportunities present themselves. Besides with four

to five husbands to cater to; her affections may not be fixed on any, thus her change of family does not produce any great psychological reaction which one would normally expect in a monogamous family. The licence permitted to the girls while they live with their parents, the indulgence they receive from the society, the annual sojourn of married girls in their parents' village during harvesting season and also during festivals, uphold this laxity in morals.

In one of our village surveys in Nada, we were met with many requests for medicine to cure barrenness and we made a house to house inquiry to determine the extent of this disability. The figures we collected were indeed staggering and I should think that along with any scheme of economic uplift a health survey should be immediately undertaken to examine the causes of sterility in the women of the area. Some primitive tribes in India allow premarital licence and women are known to take recourse to indigenous medicines to avoid the consequences of irregular unions and the effects of such nostrums have been manifest in the increased incidence of sterility among them. How far such practices are responsible for barrenness among the hill people affords a subject for inquiry. Besides, in the hills, particularly those in the neighbourhood of cantonments, incidence of sexual diseases is greater than anywhere in the plains and a medical inquiry in the villages of this region will be of great help in determining the extent of sexual disease.

We have said that polyandry is the common form of marriage among the people of the Himalayan region. It is so, as all the cultural groups in this region practise it. But it is also a fact that other forms of marriage are also practised along with polyandry. In one house there may be three brothers with one wife, in the next house there may be an only son with three wives to himself, in the next, three brothers with four wives, so that monogamy, polygyny and polyandry and even group marriage are all practised side by side. Economic considerations have been suggested as the cause of polyandrous marriages. Thus whether a man should have one wife or a group of brothers one wife is said to be 'a matter of means and land'. Economic conditions engender social habits no doubt, and polyandry may be due to the difficulties of existence particularly in the region under investigation. The Gharwalis today do not observe polyandry but the Jaunsaris do. Once I had a talk with a number of Jaunsaris on this subject. I wanted to know why the Jaunsaris still practised polyandry while their next door neighbours the Gharwalis had outgrown this practice. The answer was extremely significant. I was told that they did not envy the Gharwalis. The latter left their homes due to the disintegration of joint families. At first, land in Gharwal was measured by acres, then by roods, then by poles, then by yards and feet till they all left their village and are today

distributed all over the country as domestic servants. The Jaunsaris love their homes and do not want to repeat the experience of their neighbours.

That economic conditions shape the forms of marital relationship we may not doubt, but can a society become polyandrous if polyandry is not the customary form of marriage among the people? The custom of hypergamy which makes it obligatory for a family to confine the marriage of girls within certain limits is a widespread practice in India and elsewhere where two or more races of unequal racial or cultural status have mixed together. It leads to the custom of marrying up as opposed to hypogamy or marrying below. It forbids a woman of a particular group to marry a man of group lower than her own in social standing and compels her to marry in it or above it, while man can marry in the group or below it. If we take a society with three social classes, A, B and C and all hypergamous, we shall find that men belonging to A can marry in A, B and C. Men of the B class can marry in B as well as C. Men of the C class must confine their marriages to their own class. Girls belonging to B can marry in B as well as in A, while girls of A must marry within A. If the sexes are equal in all the three classes, as they usually are, the girls belonging to A will have difficulty in getting married while boys in C will have a restricted choice and therefore will find difficulty in securing wives. In the A group polygyny may develop due to excess of females, in the C group polyandry is a possible consequence due to scarcity of women. But we find that in practice such situation has not developed. Instead in the A class the bridegrooms are at a premium and in the C class brides are at a premium. While in the A class bridegrooms are bought, in the C class purchase of brides is the rule. These customs have not led to the introduction of polyandry.

All of us know how difficult it is for the lower classes and primitive tribes to secure wives as it involves heavy financial commitment for the willing bridegroom, but such castes and tribes have not taken to polyandry. In some tribes if the bride price is not secured it is customary for the bridegroom to serve the family of the bride for a stipulated period so that he may liquidate the bride price by service and become eligible for marriage. Marriage by capture, concubinage, levirate and homosexual practices may be found along with polyandry so that economic conditions or the custom of hypergamy cannot by themselves explain the incidence of polyandry as we find in the Himalayan region.

Attempts have also been made to correlate polyandry to a disturbed balance of the sexes. Westermarck could not find any absolute correlation between them. In the cis-Himalayan region as well as in those areas where polyandry is practised there is an excess of males over females.

JAUN SAR-BAWAR.

Disparity in Sex Distribution in Jaunsar-Bawar from
1881-1931.

		M.	F.	Total.
1881	.. ..	25,400	19,717	45,117
1891	.. ..	28,435	22,262	50,697
1901	.. ..	28,349	22,752	51,101
1911	.. ..	30,518	24,294	54,812
1921	.. ..	31,567	24,056	55,623
1931	.. ..	31,922	24,853	56,775

India is a land of males, for according to the latest available figures regarding the distribution of population by sex, India has approximately 180 million males compared with 169 million females. In many European countries the women are in a majority. At the census of 1901, there were 102,826 males and 75,369 females in the Dehra Dun district and there were 39,611 married women and 56,254 married men during the same period. Figures from other parts of this cultural region will show sex disparity. This unequal proportion of the sexes may have some effect on the form of marital relationship in these parts, but then there is an obvious difficulty in accepting this position. An intensive survey of four villages in Jaunsar-Bawar undertaken by me last year, has given the following data :

Village.	No. of Families.	No. of male children.	No. of female children.	Total No. of children.
No. 1 ..	21	37	31	68
No. 2 ..	26	48	21	69
No. 3 ..	15	24	13	37
No. 4 ..	17	34	30	64
TOTAL ..	79	143	95	238

Thus in 79 families investigated there were 143 males and 95 female children, the proportion being 3 : 2; in another group of villages investigated by my student, Mr. H. Meithal, there were 139 male and 83 female children, the ratio of male to female children approximately was 7 : 4.

We have no evidence to prove that female infanticide was freely practised or is practised in these parts. The demand for labour is so high that it is not possible to believe that female

children were put to death. Today in Jaunsar-Bawar, we find that many girls after marriage do not proceed to their husbands' village because their labour is greatly needed in the household of their parents. How far polyandry is responsible for the excess of male children is a profitable inquiry no doubt, but even if we admit the physiological law which produces an excess of female offspring in polygynous animals the reverse process may not be true. Granting it to be true in animals, it does not follow that such result is a necessary consequence of polyandrous matings in man, for man differs from animals in many particulars. How far dietary conditions are responsible for difference in fecundity and fertility and in the determination of sex of children born is a problem which has received little attention. How far viability of sperm in polyandrous unions affects reproduction has not been found. From local knowledge as well as the testimony of the people themselves, it appears that the extent of sexual diseases must have some selective effects on reproduction so that female children are more vulnerable than male and the incidence of male births is necessarily higher in this area. In any case, it is legitimate to suggest that polyandry may not be the consequence of a disturbed balance of the sexes as it may itself produce a disparity in sex proportion as we have already indicated.

Even if biological and economic factors do not explain the origin of the institution of polyandry, they certainly have maintained the institution as it exists today. The origin of an institution may be due to a variety of causes, just as in the evolution of the races, we do not think monogenesis can explain the diversity of types and races. Monogenic theory fails to explain the origin of complex cultural institutions. The status of the first born in the family is an important factor in the life of most of the people living in the Himalayan region. The system of patriarchal family is consecrated by religion in Tibet and also in the cis-Himalayan tracts. The property of the father remains the exclusive property of the first born, he is, however, under the obligation of lodging, clothing and feeding his brothers. When the eldest son of a man marries, the father abdicates his trust and makes it over to the eldest son. Just as the property of the family is owned by the first born but is enjoyed by the other brothers and dependants, the various partners in the joint establishment have a share in the wife of the eldest brother. Such is the principle of Tibetan Jurisprudence that even a father or uncle may live with his son's or nephew's wife and share marital rights over her. The marriage of a younger brother with another woman is considered bigamy as it is incompatible with the principles of Tibetan marriage. We have already referred to the status of the first born in Jaunsar-Bawar and similar evidence has been provided by others who have written on the people living in other parts of the Himalayan region.

Marriage has always been a group contract. Where the sanctity of a marriage is not established it is taken as a means of uniting two families or even two villages or clans. If marriage is a group contract, as it essentially is, the marriage of a woman with a group of brothers is not a unique phenomenon. That the various branches of the Aryan race had practised some such form of marriage can now be readily understood. Briffault, in his 'Mothers', has provided unmistakable evidence regarding the widespread practice of polyandry among preliterate and literate people in precontrol and control days, that is in both savage and civilized societies. But polyandry has existed side by side with other forms of marriage and thus the existence of polyandry in the society does not represent a survival as the historical anthropologists suggested, or even as a stage in the evolution of marriage, for we find it present even today in many parts of the world.

The marital life of Jaunsar-Bawar, as also of the entire Himalayan region is characterized by the inordinate freedom of women. It may be that the economic importance of women has determined the attitude of the people to the marital code, but the laxity of morals, the double standard of morality recognized by the community and the freedom with which marriages are annulled and entered into, are difficult to explain from a merely economic standpoint. The frequency of divorce and dissolution of marriage commonly known as the *Reet* has introduced problems extremely tragic in themselves, and an understanding of the implications of the marital life in these parts is necessary before any steps may be taken to remedy the situation. We have already discussed the various possible causes of polyandry in this cultural region and we have found how difficult it is to pin ourselves down to any of the interpretations given above. It appears, however, that the entire Himalayan region particularly the cis-Himalayan tract has its own story to tell about the characteristic social life one meets there, for such problems, as are found there, may be due to contacts between two distinct matrices that still survive in various traits otherwise inexplicable.

Without accepting the theory of unilinear progress of human society it may be said that many of the aboriginal tribes, Australoid or Pre-Dravidian, have passed through a matriarchal stage of culture, survivals of which are found today in couvade, laxity of morals among women and an economic independence difficult to interpret otherwise. The Tharus of Nainital Tarai who represent an aboriginal stock in these parts and who were more widely distributed in earlier days possess certain customs which can be explained as relics of a matriarchal culture.¹ For

¹ Some Aspects of the Matriarchal Culture of the Tharus and Bhoksas of Nainital District, by D. N. Majumdar. *Jubilee Volume of the Journal of the Bombay Anthropological Society.*

example, the women among the Tharus possess certain privileges which are denied to women in most parts of the country. The Tharu women do not allow their husbands to touch the water jars where water for drinking is stored. The Tharu women never salute the men who may stand to them in superior relation, they only bow but never touch the feet of their male superiors. The Tharu women go out to make purchases while their husbands carry them home. The Tharu women are expert painters and their mural paintings consist of pictures and scenes depicting fights and even warriors on horse back. The Census Report of the U.P., 1931, records further peculiarities of the Tharu women. Indian women as a rule proceed to the fields very early in the morning. They have a meal at midday and work till the evening. The Tharu women, on the other hand, go to the fields after a good meal corresponding to an English breakfast. At midday they eat some grain and then return home in time to cook and prepare the evening meal for their men folk. They thus work two to three hours less than the women of other tribes and castes. Again, Tharu women, unlike other women, do not carry paddy seedlings to the fields where they have to be transplanted. The seedlings have to be carried by the men. Other women carry them on their heads, thus saving the expense of a labourer or two. The Zemindars did their utmost to change these conditions, but rather than change their mode of life they chose to leave the fields altogether. The result was a migration of the Tharus to Nepal and other tracts. The women among the Tharus thus wield great authority in social and domestic spheres, and even in the activities of an economic order they have assumed the rôle of leadership. Occupations which are taboo to women in other parts are pursued with consummate skill and enterprise by the Tharu women and even hunting, fishing and fowling are done by them.

The settlement of a purely patriarchal people, like the Indo-Aryans, among a predominantly matriarchal people, viz. the Doms, has certainly led to cultural fusion and acculturation. It is on this assumption that we can explain some of the important traits-complex in the cis-Himalayan region, as for example, the double standard of morality practised by the women. Matriarchal social life is incompatible with rigid rules and taboos fettering the free movement of the women, but patriarchal society cannot function unless the woman is loyal to the family of the husband and thus a conflict arises between duties and rights resulting in a compromise in behaviour patterns as we meet in Jaunsar-Bawar and other parts of the Himalayan region. The latitude granted to a woman in her parents' house is reminiscent of the matriarchal life, while the circumscribed freedom of the wife in her husband's village indicates the ascendancy of the patriarchal code over the matriarchal. Even today a woman returns periodically to her parents' village to

assist the latter in household and agricultural work and during festivals and ceremonies she must come back to her native village to pass the time in the company of her friends and relations on her parents' side. This custom, however, produces an interesting grouping of the village units and is responsible for much of the laxity in morals and peculiar behaviour patterns which characterize the hill community. The exogamous rule does not allow girls of the same village to marry within the village, though extramarital sex relations are possible and are not noted as serious offence by the local group. The girls of the family or village who may belong to two to three generations (as for example, grandfather's sisters, father's sisters and own sisters) are all known by the classificatory term *Dhyanti* and include the prohibited degrees of relationship. The diagrammatic arrangement given below will illustrate the nature of social stratification and grouping commonly met in Jaunsar-Bawar. As the village is usually inhabited by members of the same *Got* or clan, marriage must be arranged outside the village. But even if the village contained more than one clan, marriage within the village group may not be desired on account of the latitude in sex life obtained in the village.

$$\begin{array}{l}
 \text{X } \begin{array}{l} \sigma \{ A_1 \ A_2 \ A_3 \ A_4 \ \dots \ \dots \} \\ \rho \{ b_1 \ b_2 \ b_3 \ b_4 \ \dots \ \dots \} \end{array} \left\{ \begin{array}{l} B_1 \ B_2 \ B_3 \ B_4 \ \dots \ \dots \\ a_1 \ a_2 \ a_3 \ a_4 \ \dots \ \dots \end{array} \right\} \\
 \text{Y } \begin{array}{l} \sigma \{ A_1 \ A_2 \ A_3 \ A_4 \ \dots \ \dots \} \\ \rho \{ a_1 \ a_2 \ a_3 \ a_4 \ \dots \ \dots \} \end{array} \left\{ \begin{array}{l} B_1 \ B_2 \ B_3 \ B_4 \ \dots \ \dots \\ b_1 \ b_2 \ b_3 \ b_4 \ \dots \ \dots \end{array} \right\}
 \end{array}$$

If we take two villages between which marriages are usually arranged and if we denote the males of one village as $A_1 \ A_2 \ A_3 \dots$ and the females as $a_1 \ a_2 \ a_3 \dots$ and the corresponding units in the other village as $B_1 \ B_2 \ B_3 \dots$ and $b_1 \ b_2 \ b_3 \dots$, X would give the normal arrangement of units for an exogamous village, but the second situation, viz. Y arises on account of the social custom of the periodical migration of *Dhyantis* from their husbands' village to that of their parents. This periodical exodus of women in these parts is a compromise trait that owes its inception to the impact of cultures and not to the economic necessity of assisting parents as would be superficially evident.

There are other traits which point to a fusion of cultures already indicated. For example, when a matriarchal society comes in contact with a patriarchal and a miscegenation takes place between the people of these diverse cultures property consideration makes it necessary for children to be affiliated to the parent who owns the property. Thus metronymic designation is found with matrilineal residence and matrilineal inheritance, as otherwise the children would not be cared for by the patriarchal group to which the father may belong. So the children of a woman who leaves her matriarchal moorings and comes to live with a man of the patriarchal society must

receive patronymic designation or in default some arrangement should be made by the community to allow them to inherit some part of the property of their father or mother. But a compromise trait may develop as it has in Jaunsar-Bawar and neighbouring hill States, which makes it possible for a Bhat (or Brahmin) or a Rajput, for example, to remain a Bhat or a Rajput even when he marries a Kanet girl, the children, however, are called *Sarteras*, though it is possible for the latter to regain the status of the Bhat or Rajput after two to three generations. A Bhat or a Rajput is not allowed to marry a Koli girl or any girl belonging to the artisan castes who are recruited from the Dom element. Should a Bhat or a Rajput girl marry a Kolta or Dom, the children must be affiliated to the father's caste and receive patronymic designation. Sex relations are allowed, but strict rules are in force prohibiting any social intercourse between a Brahmin or Rajput, and Kolta or Dom woman. A Brahmin or a Rajput may even be allowed to keep a Kolta woman as his mistress, but he should not be seen to smoke or drink with her. When a Bhat girl marries a Kanet in the Sirmoor State, she becomes a Kanet, but if a Kanet girl marries a Bhat she may remain a Kanet or become a Bhat.

In the matter of inheritance also we find that the hill code differs materially from that of the orthodox Hindu, as it allows a woman to inherit her father's property in the absence of any male issue by the same father. So long she remains unmarried or even after marriage should she reside with her husband in her father's village, she can own and use the property in anyway she likes. If she leaves her house and proceeds to live with her husband, she forfeits her claims to the property which passes on to the collaterals. A widow in Kulu and other areas can inherit the property of her deceased husband and even keep a partner to live with her in her husband's house though she cannot formally marry any one and retain her life title to the property at the same time. Not only in the economic sphere but in the matter of sex the woman is given an inordinate latitude incompatible with the patriarchal code. In Sirmoor and other Punjab Hill States where polyandry is the prevailing form of marital relationship, the joint wife sleeps with all brothers in the same common house or dormitory and complete freedom is allowed to the wife to choose her mate for the night. She naturally makes her choice earlier in the day in consultation with her husbands, but she does not usually bestow her favour in such a way as to arouse suspicion about her intimacy with any particular husband. The joint wife by tradition and upbringing knows her responsibility and meets the wishes of her spouses as best as she can. Enquiries on this subject have elicited frank answers from the wives and it may be mentioned as a general rule that a wife may sleep with a particular husband every night but must also meet the demands of the other husbands by turns. A

number of girls admitted that they were fond of one of the husbands but they did not object to having sex relations with other husbands if and when they wanted them. When asked why they did not live with the husband they were fond of instead of living as the spouse of the other husbands as well, they did not think it was necessary as the other husbands did not grudge her freedom in this respect. When economic conditions improve and the head of the family can spend some money over the purchase of another wife she does not object to a second wife and some wives have confessed to us that for years they have been living under monandrous conditions.

The importance of the maternal uncle in a patriarchal society where cross-cousin marriage is not popular, furnishes another argument for a matriarchal matrix in these parts. The mother's brother has an important rôle to play in the marriage of his nephew or niece. It is he who finds out mates for his sister's children. He arranges the ceremony, manages the function and receives presents from friends and relations. As child marriage is very popular in the hills, the child bride is carried on his shoulder by the maternal uncle and when the couple return to the house, it is usually the maternal uncle who supervises the propitiation of spirits and the worship of benevolent gods and goddesses.

Thus we find that the superimposition of a patriarchal culture on the matriarchal matrix has been responsible for many of the traits characteristic of this cultural region. The feudal system which still survives in this part largely accounts for an elaborate territorial organization based on a confederacy of *Thokdars* or *Sayanas*, and also consequent desire to concentrate power in the senior male member of the family. These have given rise to a rigid code of joint living and co-partnership and may have sanctioned the prevailing type of marital life in these parts.

In our description of the physical features of the Khasas we had emphasized the fact that the hill people do not represent an undiluted stock and the Doms have received Khasa infiltration. The physical features of the artisan castes, such as the Bajgirs, the Koltas, the Oadhs and others, provide ample proof of this fact. But the hypergamous practice of the Khasas has prevented the Khasa girls from marrying the Doms while the Dom girls married to Khasas did not receive Khasa affiliation. Nor did the Khasa girls marrying the Doms or members of the artisan castes retain their castes. So that the intermixture of the two people on the one hand prevented much dilution of Khasa blood and on the other contributed to great admixture among the Doms. It is not improbable, however, that polyandry would be hailed as a welcome means of keeping the Khasa blood free from wholesale contamination though Khasa infusion must have contributed to a large scale admixture among the inferior

groups. The peculiar economic conditions of the hills and the biological factor of sex disparity where it exists have no doubt largely determined the form and functions of the traits-complex, but had it not been for the matriarchal matrix the polyandry of the Himalayan region would not have assumed the importance it possesses.





1. A Hill View showing the terraced fields and the valley.



2. A Khasa Woman working in the field.





5. A Jaunsar Belle of Lakha Mandal, Chakrata Sub-Division.



6. A Beautiful Khasa Woman of Nada, Chakrata Sub-Division.



7. A Khasa Girl in her Bridal Dress.



8. A Group of Child Brides.



9. A Couple of Khasa Women Married to a Group of Brothers.



10. A Polyandrous Family with a daughter on the eve of her departure for her Husbands' village.

Notes on the Life and Labours of Captain Anthony Troyer.

By SIR AUREL STEIN, K.C.I.E.

During the laborious years, 1888–1899, spent by me at Lahore I devoted whatever scanty leisure could be spared from teaching duties and exacting administrative work, to the task of critically editing, translating and annotating Kalhana's *Rājatarāṅgiṇī*, the oldest extant Sanskrit Chronicle of the Kings of Kashmīr. In the course of these protracted labours supplemented by such antiquarian tours in Kashmīr as vacations allowed me to make, I became necessarily interested in the person of Captain Anthony Troyer, a predecessor in this difficult task. His career had been very varied, and his life had been spent in many lands. Returning after two prolonged periods of service in India, first at Madras and after an interval of more than ten years at Calcutta, he published in 1840 at Paris an edition of the Sanskrit text of the first six cantos of the Chronicle with a French translation under the auspices of the *Société Asiatique*.¹ Twelve years later he followed this up with a translation of the remaining two cantos containing the greater portion of the work, an *editio princeps* of the whole of the text having been printed in 1835 at Calcutta.

Kalhana's 'River of Kings', as practically the sole extant product of Sanskrit literature possessing the character of a true chronicle, was bound to attract attention ever since European scholars became aware of its existence. Moorcroft, that intrepid but ill-fated explorer, had shown zeal and judgment when during his stay at Srinagar in 1823 he secured a copy from the oldest then known manuscript. But the *editio princeps* produced from it at Calcutta in 1835 was far too defective in many respects to serve for a serious interpretation. The grave shortcomings of Troyer's effort based on the same materials have long ago been recognized by all qualified Sanskrit scholars. The patient industry and perseverance of the aged scholar might well claim recognition; but there could be no doubt that the great Indologist, Professor George Bühler, was justified in

¹ *Rajatarangini—Histoire des rois du Kachmir*. Traduite et commentée par M. A. Troyer, Membre des Sociétés Asiatiques de Paris, Londres et Calcutta, et publiée aux frais de la Société Asiatique. 1840. Paris. Vols. I, II.

Vol. II contains in its second part an 'Esquisse géographique et ethnographique du Kachmir, ancien et moderne'.

judging that Troyer had undertaken a task very much beyond his strength.

This failure was due largely, as I have explained elsewhere,¹ to the insufficiency, in general, of the materials available to European scholars at the time, and in particular to the fact that for the full comprehension of Kalhana's narrative such familiarity was needed with the topography, physical and economic conditions, and other local features of Kashmir as could not be obtained from outside then or since. But the shortcomings of the translator and commentator are still more readily understood—and excused if account is taken of Troyer's career and his preceding work in fields wholly different from Oriental research. It is the distinct interest presented by Troyer's personality and life which prompts me to record here what information the help received from a revered teacher, a War Office now defunct, and two kind friends has enabled me to gather from widely disparate sources in the course of decades.

It was from a fairly detailed obituary notice contained in the Annual Report presented in 1866 to the Société Asiatique by its Secretary M. Jules Mohl,² the distinguished Orientalist scholar, that I first became acquainted with the main outlines of Troyer's singularly varied life story. As Mohl tells us in the introductory remarks of this notice, the information he recorded was based solely on his recollections of conversations with Troyer when the latter, arrived at a very great age, was leading a life of studious seclusion at Paris. Mohl took care to warn his readers that these recollections were incomplete and might prove inaccurate on some points.

This warning, as we shall see, has proved justified in the light of later enquiries. It had been emphasized by that great Sanskrit scholar, Professor Rudolf von Roth, my master, when in 1893 in response to my enquiries about Troyer he showed me the great kindness of copying out with his own hand Mohl's notice. Roth, when working in Paris in 1845-6 under the guidance of Burnouf, had occasion to meet Troyer. He remembered some quaint features in the habits of the old gentleman who in his retirement was *inter alia* fond of putting his birth even earlier than that indicated in Mohl's notice. This would have made him nearly a centenarian at the time of his death. Roth's critical sense duly recognized the need of controlling Mohl's recollections by a search elsewhere for data

¹ *Kalhana's Rājataranginī*. A Chronicle of the Kings of Kashmīr, translated with an Introduction, Commentary and Appendices, by M. A. Stein. Archibald Constable & Co., 2 vols. quarto. Westminster, 1900. See Vol. I, pp. ix sq.

² See *Rapport Annuel fait à la Société Asiatique* par M. J. Mohl, Paris, 1866, pp. 13-18.

concerning Troyer's chequered life. But owing to absorption in my subsequent Central-Asian explorations and labours in other fields the opportunities for this came to me only after years. Hence in a note to the preface of my annotated translation of the Chronicle¹ I could do no more than reproduce an abstract of the essential statements contained in Mohl's biographical notice.

It is probable that even now additional facts of some interest concerning Troyer's life and manifold contacts in widely separate spheres might be brought to light from different sources. But since now the kindness of my friend Colonel R. H. Phillimore, late of the Survey of India, has recently made me acquainted with the result of his researches, illustrating what must be considered by far the most important portion of Troyer's life work and one hitherto left unnoticed, it seems time to sketch here what we know at present of his strangely diverse career.

According to Mohl's story Anthony Troyer was born in Austria about 1769 and having received his education in a military institution left it as an artillery officer. During the campaign of 1792 in Flanders he was stationed in an abandoned monastery and by a curious incident there was led first to Oriental studies. One day he found his artillery men about to make up cartridges for their guns with pages torn from a fine polyglot bible. Having saved the volume from their hands he beguiled his leisure with the study of an Arabic version of the New Testament. After his transfer to the Austrian army in Italy he was attached, evidently as liaison officer, to the English naval force co-operating at the siege of Genoa in 1800. In this capacity he made the acquaintance of Lord William Bentinck, and this changed the whole course of his life. Lord William Bentinck formed a friendship with the capable young officer and on his appointment as Governor of Madras in 1803 brought him out to India as a member of his staff. For this purpose, as Mohl tells the story, it was necessary for Troyer to hold a commission in the British army. So he was provided with a captaincy in a Ceylon Rifle Regiment about to be raised. He is said to have promptly sold his brevet and to have then proceeded as a retired officer to India with Lord William Bentinck. In Madras he then was, so Mohl tells from recollection, officially charged with a course of instruction in mathematics and thereafter became Principal of the Muhammadan College.

Vague and slightly anecdotic as this information about Troyer's start in life seemed, it was sufficient inducement to take the chance of my passage through Vienna in September, 1902, of making an enquiry at the Austrian War Office as to

¹ See Stein, *Kaṭhaṇḍa's Rājatarāṅgiṇī*, etc., Vol. I, p. x, note 7.

what might be found in its records about Captain Anthony Troyer. The result to my pleasant surprise was the receipt of authentic information unexpectedly prompt and detailed. When addressing my verbal request to the officer to whom I was directed in the Historical Section of the War Office he at once declared himself quite familiar with the name of Captain Anthony Troyer and his career also, as far as it had lain in the Austrian army.

There on his table lay a file concerning the planned publication of the materials contained in a history of the campaigns fought in 1794 by the Austrian forces in the Low Countries, Germany, and Italy, which Troyer had prepared in five foolscap volumes. On account of its excellence this history was declared in 1816 a model for similar official records of campaigns. I regret that I have since taken no steps to ascertain whether and when the intended publication of Troyer's work actually took place.

It was a curious play of chance when two days later by the courtesy of the Imperial and Royal 'Kriegs-Archiv' there was placed at my disposal a detailed and fully authenticated record (No. 2036 and No. 568, dated September 25th, 1902) of Troyer's career in the Austrian service. It comprised the time from his entry into the Military Academy at Wiener-Neustadt, founded by, and called after, the Empress Maria Theresia, until 1803 when his application for two or three years' leave to accompany the newly appointed Governor of the Madras Presidency was granted. Of Troyer's life after his departure for India nothing was known to the Historical Section of the Vienna War Office. Hence the succinct account I could in return furnish relating to his employment in the East India Company's service and his scholarly work later was welcome.

It is from that official record, provided with all needful references to the original documents, that I glean the following essential data. Anthony Troyer von Aufkirchen was born in 1775 at Klattau in Bohemia. This fact proves that his age at the time of his death, as recorded in Mohl's notice, was distinctly overestimated and confirms the doubt Professor von Roth had expressed on this point when writing to me on February 26, 1893. Troyer was the son of Lieutenant Joseph Troyer von Aufkirchen, of the Austrian Dragoon Regiment Josias Prinz zu Sachsen-Coburg-Saalfeld. In 1787 he was admitted into the Military Academy at Wiener-Neustadt, a famous institution which as long as there was an Austrian army, supplied the élite of its corps of officers. In 1791 he received his first commission as cadet-ensign in the Infantry Regiment No. 38 and was promoted in the same first to Ensign and then in 1793 to Second Lieutenant.

He took part with his Regiment in the campaigns in France, the Low Countries and on the Rhine, and was wounded

near Valenciennes in 1793. Attached to the Quarter Master General's Staff he greatly distinguished himself during the actions fought in 1795 near Düsseldorf and, in consequence, was in that year promoted to First Lieutenant on the Quarter Master General's Staff. On account of illness he did not take part in the campaign of 1796, but served in the following year in the Rhine army. In 1798 he was ordered to Italy for survey work, was subsequently attached to the army operating there and was wounded at the battle of Novi in 1799. Meanwhile he had received promotion as Captain in the Quarter Master General's department. He served during the campaigns of 1800 and by May 1801 was appointed to the newly established 'War Archive' or what corresponds to the Historical Section of a modern War Office. It was during this employment that Troyer was charged with preparing the record of the campaigns of 1794 in the Low Countries, Germany, and Italy, above referred to, the value of which was specially culogized years later.

After nearly two years' work in that post Troyer applied for two or three years' leave in order to accompany Lord William Bentinck who had invited him to proceed to India as a member of his household. As he explained in his application, he could hope there to acquire a competence and therefore would renounce any claim upon future provision by the Austrian Government. His application was duly granted by an imperial resolution of February 23, 1803. In order that his post on the Quarter Master General's Staff might be filled he was transferred without pay as 'supernumerary on leave' to the Infantry Regiment No. 49. As he did not return from leave and no information about him was received, his name was at the Regiment's request removed from its cadre in March, 1809.

The record here reproduced affords ample evidence that Troyer's career as a young officer in the Austrian army, comparatively short as it was, had offered him opportunities to distinguish himself in the field and to display marked intellectual abilities. His four years' training at an early age in the foremost military institution of old Austria was bound to have played a chief part in developing them. It may safely be assumed in particular to have laid the foundation to his scientific knowledge of surveying methods and practice.

This, as we shall see further on, enabled him in Madras to render very important services to the army in India, by providing its first staff of officers specially trained for systematic topographical survey work. In this respect the reference in the record to his employment on topographical surveys in Italy is of special interest. It proves that as a young officer on the Quarter Master General's Staff, for which he, no doubt, had been selected on account of his superior training and mental capacity, he had opportunities to acquire practical experience in survey

work with the plane-table. The use of this he was to be there after the first to introduce for surveys in India.

The record makes no mention of the special circumstances which during the Italian campaign of 1799-1800 offered the opportunity for Troyer to come to the notice and acquire the friendship of Lord William Bentinck. On the strength of Troyer's recollection as reproduced in M. Mohl's notice, it may safely be assumed that it was the siege of Genoa in 1800 by the Austrian army under General Melas which by chance determined the whole course of Troyer's subsequent life. Lord William Bentinck, then a youthful Colonel, was attached as the military representative of England to the Austrian army in Italy during the years 1799-1801.¹ As such he was, no doubt, present before Genoa when the strongly fortified city, blockaded from the sea by a British naval force, was ultimately surrendered by Masséna owing to famine among its population.

If Troyer was acting as a kind of liaison officer between the Austrian army before Genoa and the British naval force he would have been bound to be often brought into contact with Lord William Bentinck. His abilities could scarcely escape so good a judge of men as Lord William Bentinck proved all through in the high offices which he was destined to fill. It may, perhaps, be conjectured also that Troyer's linguistic talents, as amply displayed later in his Indian studies, and indicated by the story of Mohl about his interest first aroused in Arabic, attracted Lord William Bentinck's attention. Troyer's selection as liaison officer with the British command may well have been due to a knowledge of English, an accomplishment probably very rare in those times among Austrian army officers.

The exact information secured at Vienna about the early part of Troyer's career induced me next to apply to Mr. (now Sir) William Foster, C.I.E., late Superintendent of Records at the India Office, for data concerning Troyer's later employment in India. That ever helpful friend was kind enough to furnish me on December 5th, 1902, with a memorandum based on the records of the East India Company but not intended for publication as it stood. From this it was seen that Troyer accompanied Lord William Bentinck to Madras in 1803, having been provided, probably through the latter, with a commission as Ensign in His Majesty's 12th Foot. He was not attached at that time to the Governor's Staff.

¹ See Boulger, *Lord William Bentinck*, Oxford, 1892, p. 16. The interest subsequently shown by Lord William Bentinck in Troyer might, perhaps, be partly accounted for by what Boulger states in a note: 'In one of his despatches, he (Lord William Bentinck) bore eloquent testimony to the valour and devotion of the Austrian army, which he found far too few to appreciate it. "It is impossible to do justice to the valour and perseverance of the Austrian army," he wrote.'

In 1804 Lord William Bentinck proposed a plan for the establishment of a class for the special instruction of a certain number of cadets in topographical surveys. This proposal having been accepted by the Council, Major General Dugald Campbell, Commander-in-Chief at Madras, on November 12th, 1804, nominated, probably at the prompting of the Governor, 'Ensign Anthony Troyer, of His Majesty's 12th Foot', as Drawing and Mathematical Instructor for this class. This nomination was promptly followed on November 13th by his appointment to the post on a salary of 250 Pagodas per mensem. The plan and Troyer's selection for the post were finally confirmed by the Court of Directors on the 30th July, 1806, Troyer having meanwhile been promoted to the rank of Lieutenant.

The class soon developed under Troyer's direction into the Madras Military Institution. In a Military Letter, dated 24th October, 1808, as quoted in Sir William Foster's memorandum, the Madras Government speak highly of the results of the establishment of the Institution and praise the 'zeal, attention and ability' of Lieutenant Troyer. From this and other more incidental references to Troyer's work at Madras quoted in Sir William Foster's memorandum, it became abundantly clear that his activity during the first period of his Indian service soon fully justified the judgment displayed by Lord William Bentinck in bringing his friend to India and in providing for him a field of work worthy of his capacity and to the advantage of Government.

But it was only when I turned lately to Colonel R. H. Phillimore for any information which, as a late Officer of the Survey of India, he might be able to trace about Troyer's activity at Madras, that I became aware of the importance which must be claimed for it. For several years past Colonel Phillimore has been engaged on a full history of the Survey of India, that great department of the Indian Government which for nearly a century and a half has rendered very notable services not only to the administration of the sub-continent but to geographical research over a still vaster area of Asia. In the course of painstaking search in the archives of the Madras Government he collected much interesting information about the working of the Madras Military Institution which owed its creation to Lord William Bentinck's initiative and its success to Troyer's zealous direction. From this I have been enabled through Colonel Phillimore's kindness to gather the following data.

"Stimulated by a recommendation made in 1804 by the Surveyor General in Bengal to the Bengal Government, the Commander-in-Chief at Madras, General James Stuart, had urged his Government that more officers should be trained as Surveyors in order to facilitate the extension of surveys into the unmapped territories added to the Presidency since the defeat of Tipu in 1799. Lord William Bentinck took up the matter

with enthusiasm and in a minute of September 24th, 1804, proposed that 'a select number of the Gentlemen Cadets' at Tripasore shall be instructed in the art of topographical surveys by an instructor capable of giving the double lesson in Geometry and Military Drawing'. The suggestion having been accepted by the Council the succeeding Commander-in-Chief at Madras, General Dugald Campbell, recommended the appointment of Ensign Troyer, of His Majesty's 12th Foot, to the proposed post. To this he soon after added the significant recommendation that 'the plan in question having originated with the Right Hon'ble the Governor, . . . the first arrangements of it may take place under His Lordship's superintendence', as stated in the Madras Military Consultations, 13th November, 1804.

"The Military Seminary" was thereupon established, and Lord William Bentinck laid before Council on November 17th, 1804, detailed regulations for the conduct of the Institution, together with a 'plan of instruction'. It was to include from the start 'the practical part of surveying with the plane-table'."

The promptness, unusual in those days and parts, with which these regulations were prepared strikingly illustrates the keen interest with which the Governor followed up the scheme. That its inspiration came largely from Troyer is definitely indicated by the mention of practical surveying with the plane-table, a method not applied then in India but of well-established use where Troyer had received his own training.

"By April 1805 the first class of cadets passed into the Institution and like those which until 1814 followed annually in succession remained for two and a half years under instruction. Troyer's first report submitted in October, 1806, shows the extent of the scientific instruction imparted and refers to specimens of drawings of survey work done by the cadets in the field as 'exhibited every month to your Lordship'. In May 1807 Troyer submitted a long review of the course of instruction to Lord William Bentinck. A memorandum on this course and the future employment of the officers trained was submitted by him after Lord William's departure in that year and was favourably commented upon by Lambton, the founder of the Indian Trigonometrical Survey, the Astronomer at the Madras Observatory and the Quarter Master General at Madras to whom it was circulated.

"In December 1807 Troyer's hands were strengthened for the purposes of discipline by the Institution being placed under the control of the Quarter Master General under whom it still remained after the establishment of a Surveyor General at Madras.¹ In a report to Government submitted in 1808 Troyer

¹ Information extracted by Colonel Phillimore from the Madras Military Consultations and kindly communicated to me helps to throw light on this step. It illustrates the personal interest which Lord William

indicates his intention of giving lectures also on 'those astronomical problems which are in the strictest connexion with geography and of the greatest practical use'.

"The partial withdrawal of the East India Company's trading privileges by the Act of 1815 induced the Court of Directors to effect reductions in their Indian establishments. A despatch addressed by them to Madras on 5th May, 1815, ordered, among other economies, the abolition of the Military Institution, on the ground that the existence of a similar institution in England rendered the Madras one superfluous. Sir Thomas Hislop, Commander-in-Chief at Madras, recorded a protest (15th January, 1816) strongly emphasizing 'the great mass of geographical and topographical materials with which... the students of the Madras Institution have enriched the records of the Company and in some instances of the civilized world'. It points out the great value of the scientific training imparted to young officers, also that in the course of it 1,620 square miles on the average had been annually and most minutely surveyed. Stress is laid on the services rendered by pupils of the Institution when attached as Surveyors to successive expeditions outside India they 'compiled the best map of the countries between the Indus and the Nile that has ever yet been given to the world' and produced topographical information of the utmost value in territories as widely apart as the Deccan and Java.

"The Governor and Council, however, decided that the orders of the Court of Directors left them no discretion in the matter, and a General Order was approved abolishing from the 31st May, 1816, the Military Institution and the Survey branch of the Quarter Master General's department. At the same time

Bentinck continued to take in the Institution created under his auspices and indicates also a characteristic feature of Troyer's personality. After Lord William Bentinck had left Madras in 1807 Mr. William Petric, the acting Governor, proposed that steps should be taken for the better maintenance of discipline at the Institution, Bentinck's supervision no longer existing. 'Discipline would be much better maintained if entrusted to Troyer who is always on the spot.'

It was accordingly proposed to give to Captain Troyer the appointment of Assistant to the Quarter Master General. After noting that Troyer had hitherto been in no way responsible for the discipline of the pupils, the minute states: 'Every praise is no doubt due to Captain Troyer for the universal satisfaction which he seems to have given to the Gentlemen who were placed under his tuition; but probably he would not have been less fortunate, had he, at the period of his first appointment, been invested with more extensive authority.' Troyer's appointment as A.Q.M.G. 'placing him ostensibly under the first public officer of the Army, will no doubt (combined with the mildness of his manners) give him sufficient weight to maintain discipline'.

It does not appear from the records consulted by Colonel Phillimore that "Troyer ever signed himself, or was listed, as A.Q.M.G. But he is hereafter frequently designated Superintendent of the Institution, which title was probably recognized as covering his complete responsibility, in addition to being Instructor".

testimony was borne to the excellent way in which Captain Troyer and his staff had carried out the duties entrusted to them." The lasting value of the work directed by Troyer and its far-reaching effect upon the topographical surveys carried on since all over India and great adjacent regions by the Survey of India are thus summed up by Colonel Phillimore, its very competent historian.

"During the 11 years that the Military Institution existed, it remained under the charge of Troyer and he was entirely responsible for the methods of survey in which the pupils were taught and trained. Survey was carried out by plane-table on the scale of 4 inches to the mile. The plane-table survey was based on triangulated points as fixed by Lambton's triangulation, minor triangulation being carried out by Troyer or the more senior pupils. Where surveys extended beyond the area covered by Lambton, special triangulation was carried out by Garling, Troyer's most successful pupil.

"Survey by plane-table was thus introduced as a regular method of survey for the first time in India by Troyer, and all officers of the Madras Military Institution were thus brought up to regard it as the normal method of survey. Through the influence of the officers of the Institution the plane-table was, about 1824, declared to be the standard instrument of survey for all Madras surveys.... The methods taught by Troyer gradually extended to the Bengal Presidency as Madras trained officers were eventually brought up to Bengal.....

"The choice of Anthony Troyer as Instructor for the Madras Military Institution was a most happy one and of particular interest. Starting the surveys of the Institution shortly after Lambton had completed his first series of triangles along the Madras coast, he was able to introduce for the first time into India the soundest principles of topographical survey, breaking down the main triangles of the trigonometrical survey by his own minor triangles and filling the detail by plane-table, laying out the plane-table sections in a continuous rectangular grid. Holding the post of Instructor for eleven years he trained a large number of officers in this system which in its main principles has persisted to this very day."

There can be no doubt that the work done by Troyer at Madras was by far the most important achievement of his life. Yet he seems, if we may judge from Mohl's very scant reference to it, to have been strangely silent about it in the communications of his retired old age. But about a personal aspect connected with his employment at Madras the official records consulted by Sir William Foster at the India Office supply some interesting information. As it throws light on Troyer's position and also curiously illustrates military procedure at the time it may be quoted in full.

"Lieutenant Troyer had not as yet joined his regiment (His Majesty's 12th Foot), and as the Commanding Officer had resolved not to recommend him for a Captaincy unless he did so, he caused a letter to be written on 7th February, 1812, from Port Louis, Mauritius, where the regiment was then stationed, summoning Troyer either to join or to exchange into some local regiment. On 16th September, 1812, Troyer forwarded this letter to the Commander-in-Chief at Madras, and asked for instructions. In doing so he stated that he was extremely desirous of remaining in his present post without losing his position in his regiment.

"The Commander-in-Chief replied that he had no power to give leave of absence from a regiment not under his command, but he would write to the General Officer Commanding at the Isle of France and also to H.R.H. the Duke of York at home, requesting that leave of absence might be granted to Troyer without detriment to his promotion. This reply was communicated (27th September, 1812) by the latter to the Officer Commanding his regiment, with the request that the indulgence already shown to him might, if possible, be extended until he should have obtained the rank of Captain.

"On 1st April, 1813, he received a brief answer, dated 11th November, 1812, to the effect that the Officer Commanding could not grant him any leave whatever; that he had now been returned as 'absent without leave'; and that the Duke of York had approved of his being passed over in a recent selection for a captaincy. Troyer thereupon forwarded the correspondence to the Governor of Madras, pointing out that possibly the matter might yet be reconsidered, as evidently a decision had been taken before the arrival of the promised letter from the Commander-in-Chief at Madras, but stating that if his promotion in his Corps were incompatible with his retention of his post at the Military Institution, he should not hesitate to give up his prospects in the army and rely upon the favour of the Madras Government.

"The Government of Madras addressed a letter to the Governor of the Isles of Mauritius, Bourbon, etc. (11th May, 1813) apologizing for having detained Lt. Troyer from his duty; eulogizing his services and intimating that the Court of Directors would be asked to arrange if possible for the continuance of his employment at Madras. The Court of Directors was addressed accordingly (25th August, 1813).

"Nothing further on the matter has been traced; but it appears from the (British) Army List of 1814 that Troyer was appointed to the 4th Ceylon Regiment, the date of his regimental rank being given as 15th July, 1813. He was placed on half-pay on 25th July, 1815 (Army List of 1824) and remained so till his death."

From Mohl's notice it is known that Troyer while at Madras had married a French lady at Pondicherry; at what date is not

stated.¹ This explains the record contained in the Madras Military Consultations of 15th June, 1816, as kindly communicated by Colonel Phillimore: 'The Commander-in-Chief . . . at the earnest request of Captain Troyer permitted that Officer to accompany his family to Pondicherry, where he proposes to reside until an opportunity shall occur for proceeding to Europe.' Colonel Phillimore adds the information that Troyer was probably still in India when Mackenzie left Madras in July 1817; for Mackenzie writes to Mountford in October 1818: 'What is become of Capt. Troyer? Recommend me to him.'

That Troyer during his employment at Madras took up the study of Indian languages can safely be concluded from Mohl's statement that he studied there Tamil, Hindustani and Persian. But there is no evidence of his having ever been in charge of the Muhammadan College there, as Mohl indicated. But his reference to Troyer having at Madras commenced a translation into German verse of episodes from Firdausi's great epic, the *Shāhnāmāh*, may be accepted as correct. Mohl was bound to have been specially interested in this proof of Troyer's Persian study as he himself published later a monumental edition and French translation of Firdausi's *Shāhnāmāh*. He declares to have had portions of Troyer's manuscript version in his hands. It deserves also to be noted that the 'plan of instruction' for the Military Institution, which was proposed in 1804 by the Governor (Madras Military Consultations, November 17th, 1804) and was probably drawn up under Troyer's inspiration, specifies 'one of the native languages' in the first place among the subjects to be taught.

It is much to be regretted that we have no definite information about the years spent by Troyer after his retirement to Europe after 1817. According to Mohl he lived with his wife at Paris, continuing his Oriental studies '*dans une retraite silencieuse*'. It would be interesting to know something about the contacts he might easily have formed there with that leading master of Oriental studies, Sylvestre de Sacy, and other French scholars of note. It would be, perhaps, still more useful if evidence could be traced as to the way in which personal touch was maintained by Troyer with his friend and patron Lord William Bentinck.

That this contact, so important for Troyer's life, remained unbroken after Lord William Bentinck's departure from Madras and also during Troyer's subsequent stay at Paris is proved by the fact that Troyer accompanied Lord William Bentinck when he returned to Bengal on his appointment as Governor-General.

¹ The enquiries which my friend Colonel Reginald Schomberg, British Consul General at Pondicherry, was kind enough to make at my request both at Pondicherry and at Madras, have failed to trace any record relating to Troyer's marriage.

Sir William Foster's memorandum shows that the list of persons permitted to accompany Lord William Bentinck, the Governor-General designate, to Bengal, as contained in the Court of Directors' despatch to Bengal, dated 28th December, 1827, includes 'Captain Anthony Troyer on the half-pay of the 2nd Ceylon Regiment (an error for 4th Ceylon Regiment) as Aid de Camp'. In the same memorandum Sir William Foster adds the following: "The India List shows him in this post during the whole of Lord William's tenure of the Governor-Generalship. He is not shown as acting in any other capacity, nor can I find him mentioned in the letters from the Government of India to the Court of Directors. I believe, however, that the Calcutta Sanskrit College was not under the direct management of the Government, and it is possible therefore that Troyer may have had some connection with that institution without official notice being taken of it."

Mohl states that Troyer took charge of the 'Brahmanical College' at Calcutta before Lord William Bentinck left India and directed it until his own departure in 1835. Information kindly communicated by the Keeper of the Records of the Government of India shows that Troyer was Secretary to the Government Sanskrit College, Calcutta, up to January 1835. This confirms the statement made by Troyer in the Preface to his translation of the Kashmīr Chronicle as to his having held the post of Secretary to that College where certain Pandits were employed for correcting the proofs of Sanskrit texts which were being published at the expense of Government. In the same Preface Troyer mentions having left Bengal in February 1835.¹ Among the various manuscript materials which Troyer is stated to have brought back on his return to Paris as fruit of his scholarly labours at Calcutta, were those he had prepared for his edition of the Sanskrit text of Kalhaṇa's Chronicle of Kashmīr and his translation of the same.

We have no exact information as to when Troyer's study of Sanskrit had started. Nor do we know to what extent his interest in India's classical language and its vast literature may have been stimulated by the influence of such great scholars as Horace Hayman Wilson, James Prinsep, Csoma de Kőrös whom Calcutta could claim at the time of his own stay there. Wilson had been the first to acquaint European students with the general character of Kalhaṇa's Chronicle of Kashmīr by publishing in 1825 a critical abstract of its first six cantos. It was James Prinsep, the famous decipherer of Indian inscriptions

¹ Colonel Phillimore points out to me that as Lord William Bentinck's departure on relinquishing charge as Governor-General of India took place on March 25th, 1835, and, perhaps, counted from his embarkation at Madras, it is possible that Troyer accompanied him on the homeward voyage.

and coins, who, if Mohl's statement apparently based on a communication of Troyer can be trusted, made it possible for the first edition of the text, very imperfect as it was, to appear in print at Calcutta in 1835. Either of them might well have drawn Troyer's attention to the importance of the Chronicle.

I have already in my introductory remarks had occasion to point out that Troyer's equipment was inadequate for the difficult task which he had undertaken and to which he devoted himself with such assiduity for many years. A quasi-pathetic proof of this was afforded to me by a letter written by Troyer from Paris on 5th June, 1845, to Professor Horace Hayman Wilson which my friend the late Mr. A. H. Wilson allowed me to see and copy from his grandfather's very valuable store of correspondence. It deals mainly with his labours on the Kashmir Chronicle.

Referring to his translation Troyer says that he is 'undergoing a hard struggle with the two languages, Sanskrit and French', and expresses his belief that the two last cantos he was engaged on translating are not the work of Kalhana. In reality this is the most authentic and critically valuable portion of the author's historical record, but rendered often difficult by the lavish display of characteristic rhetorical skill specially appealing to Indian scholars' taste. On reading that letter, written by Troyer in his seventieth year with a remarkably clear strong hand, I felt much impressed with the remarkable perseverance which enabled the aged scholar to complete his 'arduous work', as he calls it, seven years later.

The only other work which was published by Troyer after his final retirement to Europe, was an English translation of the *Dabistan or School of Manners*, a Persian treatise of which David Shea had finished two-fifths and which Troyer completed with notes and an elaborate preliminary discourse. It was published in 1845 on behalf of the Oriental Translation Committee. It deals principally with the religious doctrine patronized by the Emperor Akbar. M. Mohl emphasizes the thoroughness with which manifold problems raised by this curious work are treated in Troyer's introduction but expresses no definite opinion as to the solutions proposed for them.

As Mohl tells us, Troyer continued to pursue his scholarly labours all through the long years of his remaining life spent in Paris, but published none of their fruits. This bears out Mohl's description of Troyer as a man wholly indifferent to fame and content to satisfy his interest in study for its own sake. From the record at Somerset House of Troyer's last will which Colonel Phillimore inspected, it is seen that he died at Royaumont on the 2nd June, 1865, in his ninetieth year, leaving two married daughters and a son (under interdiction). His wife had predeceased him.

We are told by Mohl that the tranquillity of his spirit in old age was such that neither good nor bad fortune could disturb his serene composure. Yet he seems for all that to have retained to the end a bold independence of opinion, which the perfect calm of expression made all the more striking. He is said to have faced undisturbed whatever personal losses and disappointments befell him, heavy as they seem to have been. It is hence pleasant to think that the British half-pay which good health allowed him to draw for fully fifty years, spared him serious material cares. It was a reward well deserved by the services he had rendered in India and by his devotion to India's intellectual interests.



Survivals of the Indus Culture.

By M. E. and D. H. GORDON.

(Communicated by Dr. B. S. Guha.)

The intention of this article is to indicate certain survivals from the Harappa and Jhukar cultures of the Indus Valley over to the Early Historic Period,¹ and at the same time put forward certain objects as deriving from that apparent cultural hiatus of approximately two thousand years.

When one comes to examine the objects from Harappa, Mohenjo-daro, and Chanhudaro in the light of material collected from thirty mounds in the Peshawar, Mardan, Rawalpindi, Lahore, and Montgomery Districts, all demonstrably of the Early Historic Period, certain interesting facts emerge. The small dating value of such objects as shell bangles, knob handled pot-lids, etched carnelian beads, all of which are to be found quite commonly in these sites, impresses itself on one immediately. Nor do these objects show much change: the pot-lids which are made in thousands to-day, are unaltered, shell bangles of both periods show a large range of width and thickness, carnelian beads are etched with very similar patterns, the framed Greek Cross being found at Taxila and Sahri Bahlol. In addition to these objects, Painted Pottery, as such, is found on every one of the thirty mounds mentioned, and is made to-day in all of the five districts in which these mounds are situated.

This does not mean that there is no distinction to be made between the painted pottery of the three periods, pre-historic, early historic, and present day, there are in fact more differences than there is similarity: the similarities with the later types being more readily traceable in the early pottery of Baluchistan and Makran than in the early Indus Valley types. This point requires however a great deal more investigation before any useful theories can be advanced.

Over and above these more common objects, resemblance between which might well occur without having very much significance, there are a number of other articles in which the persistence of type over the great period of time postulated, say about two thousand years, is less easily explicable, and which may possibly be of the greatest importance.

¹ The expression 'Early Historic Period' when used in this article refers to the period from the beginning of the Mauryas to the end of the Guptas, i.e. 322 B.C. to c. 500 A.D.

The first of these is the image of a bird with extended wings on a pedestal. These are common at Harappa where we examined twenty-four of them. Plate 4, fig. 1 shows one of them. Alongside this is shown a similar object, found on the surface at Bala Hissar near Charsadda in the Peshawar District. The concept is identical and also much of the execution. They are both birds with spread wings, ornamented with incised lines to indicate plumage, balanced on pedestals. The particular example from Harappa was found at Mound F only five inches below surface, one similarly incised was found at six feet below surface at the same mound, and yet another at five and a half feet below surface at Mound A-B. Bird figures on pedestals with closed wings are found both at Mohenjo-daro and at Sari Dheri, Charsadda Sub-division. The examples from Sari Dheri and the Bala Hissar date quite definitely from the Early Historic Period.

The familiar bird whistles found at all the Indus Valley sites provide the next example. A fat semi-globular bird again balances on a pedestal, having a whistle hole just above its tail. Plate 4, fig. 3 shows an example from Harappa: alongside it is a bird rattle from Sirkap, Taxila, the shape, pedestal and general style are, allowing for its rather chipped condition, identical. Grouped with the bird whistles of this type at Harappa is one found by Daya Ram Sahni in the early days of exploration there: it has no pedestal and the whistle hole, working on a slightly different principle, is in the head: along the back is a ridge rising like a cock's comb in a series of points. We have an identical one which was made recently by wandering nomads. The Harappa specimen, a surface find, is of course modern and of the same origin, but the clay bird whistle is thereby shown to exist to this day.

The next instance is possibly more peculiar than convincing. At the site of Bala Hissar in particular, a large number of figurines of an archaic type, which can now confidently be dated 200 B.C.-300 A.D., are found cut in half down the centre; in some cases it appears to be quite definite that they were deliberately cut through in this way. We were therefore surprised to find in the Harappa museum a number of figurines both male and female which had been treated in exactly the same way, Plate 5, figs. 1 and 3 show examples from both sites.

The majority of Harappa female figures, those of the Jhukar Period, if they exist, have yet to be identified, have a fan-shaped headdress. Primitive figures from Sahri Bahlol which are almost certainly of Kushan date also have a fan-shaped headdress, and so has a Hellenistic head from Taxila (Plate 4, fig. 5 and Plate 5, fig. 2).

Among the designs on the curious copper tablets from Mohenjo-daro, having a design on one side and an inscription on the other, is an elaborate looped figure. An identical figure

is to be found on a terracotta stamp-die and a terracotta stamped tablet from Taxila (Text-fig. 1). Of a similar style to this

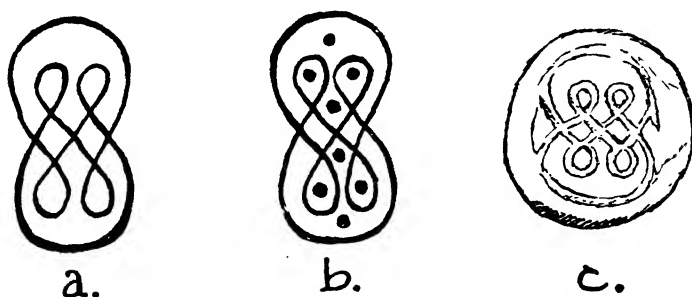


Fig. 1. Continuous looped designs from (a) Mohenjo-daro and (b) and (c) Taxila.

is an intricate pattern on the left of the seal inscription shown in Pl. XXIII, fig. 6, *Arch. Survey of India Report*, 1930-34. A similar design is cut in the floor of the main sanctuary at Kailasa, Elura, and designs of this type are made down to the present day. Regular continuous designs have a wide distribution and a long history, and their diffusion in the Melanesian region, attested by the late Mr. Deacon's work in that area, may be one of the links by which the scripts of Mohenjo-daro and Easter Island hang together.

From Akhkari Dheri, Risalpur, Peshawar District comes a potsherd having on it a peacock, conventionalised, so far as can be seen, in the same way as those on the burial jars at Harappa, particularly as regards the egg-shaped cross-hatched body. Plate 6, fig. 1 shows this sherd with added reconstruction, wings and fan-shaped tail are both clearly indicated in the surviving part, the only conjectural feature being the peacock crest, the fan-shaped tail is however a justification for its possible correctness. From Taxila comes an urn lid from the Mahal area near Sirkap with a design of cross-hatched segments, trees, and peacocks, which definitely associate it with similar lids on burial jars at Harappa. The date of the jar burials at Harappa is at present a matter for conjecture. The style of painting has but the very slightest resemblance to that of the Harappa Period; besides which, as we have observed *in situ*, the Harappa pottery, both plain and painted, accompanies the extended burials.

In the Harappa museum are animal figurines very closely resembling a pig made out of a lemon and four sticks. A figurine exactly of this type, except that it is covered with incised decoration, was found at Sari Dheri. From Chanhudaro also come small four-legged pottery stands supposed to have been used for cosmetics. These have their exact counterpart

in small four-legged blue schist stands from Buddhist sites all over the Gandhara region. The strange fragments of very thick sectioned pottery with deeply incised patterns found at Mohenjo-daro can also be closely paralleled from these sites.

Finally, 'Dr. C. L. Fabri, in his article on 'Latest attempts to read the Indus script',¹ discussing the possible use of copper tablets from Mohenjo-daro as coins, suggests a similar use for the seal impressions. These he holds are a forerunner of the punch-marked coins, as 'a form of stamped obligation to pay a sum'. There is much to be said for this idea, but in our opinion there is a more striking survival of this usage than the punch-marked coins. From many mounds in the N.W.F.P., but particularly from Kula Dheri near Charsadda, there come small baked tokens each marked with a seal impression made by the typical intaglio seals of the period 1st Cent. B.C. to 3rd Cent. A.D. We have more than thirty of these, of which quite two-thirds come from Kula Dheri, indicating their existence in very large numbers. These baked clay sealings are, we feel certain, tokens issued by merchants, and therefore had the same function as is assigned by Dr. Fabri to the seal impressions at Harappa and Mohenjo-daro.

Though no very definite conclusions can be arrived at by evidence of this kind, two points stand out very clearly. The first is the rejection by any reasonable mind that these striking similarities are quite fortuitous and in no way related, the Indus types having perished without immediate successors round about 2200 B.C., only miraculously to reappear two thousand years later, from about 200 B.C. onwards. The second is that the interpretation at the Indus Valley sites of the first ten feet of deposit, which, through quarrying, erosion, day to day complication by objects dropped down holes and recovered by earth and misplaced in countless other ways, is so difficult and yet so important, has been a complete failure.

It has been reiterated constantly that there must be links to fill this gap of two thousand years, and it has been urged that digging at such sites as Kosambi and Ramnagar would produce such links.² Mohenjo-daro, Harappa, and Jhukar all have plentiful remains of the Early Historic Period on the surface. It is true for the reasons we have given, that the upper levels of these sites are more difficult to handle than would be the case with the lowest levels of Kosambi or Ramnagar, but it is unfortunate that because of these complications no real effort has been made to reconcile a number of unaccommodating objects with a more acceptable chronology.

¹ *Indian Culture*, Vol. I, No. 1.

² In particular by Sir Leonard Woolley in his report upon Archaeological research in India, where he stresses that further work on the pre-historic sites should be postponed and effort concentrated on bridging this gap.

We must refer yet again to that outstanding article by R. Heine Geldern, 'Archaeological traces of the Vedic Aryans',¹ which is the first really valuable contribution to knowledge on this subject. In linking up Tepe Hissar IIIc, with Transcaucasia and Turang Tepe and establishing a definite date for the adze-axe at Mohenjo-daro, and at the same time its spread via the Caucasus and North Persia, he produces the evidence of animal headed pins and also objects which he terms double animal protomes. Such objects exist at Harappa and Mohenjo-daro.



Fig. 2. Animal Headed Pin from Harappa.

From Mohenjo-daro comes a double headed pin very similar to the type found at Tepe Hissar, dated by Heine Geldern to the IIIc, phase, and from Harappa a pin or rod having a wolf attacking an animal with spiral horns placed on a cross bar. The former was found at the D.K. area at twelve feet below datum and the latter at Harappa one foot below surface and so immediately comes under suspicion (Text-figs. 2 and 3). The style of the Harappa pin is very similar to some from Tepe Hissar and also to a gold Ibex from tomb IV Mycenae which can be dated to the second half of the 16th Cent. B.C. (Bosseret's *Ancient Art of Crete*, fig. 191). At Harappa we found a double animal protome in terracotta almost identical with Heine Geldern's Transcaucasian example; it is in poor condition though quite recognisable by its two heads and curious shape. These few objects may not seem very impressive but they are even less so when suitably kept in the background; they indicate, however, the presence of material which is referable to the middle of the second millenium B.C. at the earliest.



Fig. 3. Double Headed Pin from Mohenjo-daro.²

¹ *Journal of the India Society of Oriental Art*, Vol. IV, No. 2, December 1936. Already quoted by us in our article in *Iraq*, Vol. VII, pt. 1, 1940.

² Figs. 2 and 3. Published by Courtesy of the Archaeological Survey of India.

In addition doubt may reasonably be cast on the dates as now assigned to the following objects:—

- (a) The steatite bearded head with the trefoil robe which has the most striking resemblance to figures of the Sangari and Kadshi, Asiatics on the chariot of Thothmes IV,¹ and is therefore quite possibly not earlier than the first quarter of the second millenium.
- (b) Seal from Chanhudaro, Jhukar Period, showing antelope and flower, is of an Eastern Mediterranean style not earlier than Middle Minoan III, second quarter of the second millenium.
- (c) Seal from Chanhudaro, Jhukar Period, showing ibex, having North Persian affinities similar to the double animal protomes and animal headed pins, dateable to the second or third quarter of the second millenium.
- (d) The shaft-hole hammer-axe from Chanhudaro, not to be dated prior to 1800 B.C.²
- (e) The famous bronze adze-axe with tubular collar, dated by Heine Geldern to 1200–1000 B.C., but in any case not older than the middle of the second millenium.
- (f) The two Harappa statuettes of red limestone and dark grey slate, which cannot by anyone who has held them in their hand and examined them closely, and has a fairly unbiassed mind, be assigned to any date earlier than the 3rd Cent. B.C. at the earliest.
- (g) The terracotta head with moulded bearded face and high pointed cap, found somewhere in the Mohenjodaro D.K. area, which we assign without any hesitation to either the Indo-Parthian or Kushan Periods.³

To these must be added the fact that at Harappa there is a great deal of painted pottery which shows no affinities with that of the 'Harappa Period' but may be of the same period as the burial jars and to which as yet no date can be given, but which must be located somewhere in the two thousand year gap. Painted pots of Jhukar type and pots of Jhangar ware are also non-existent at both Harappa and Mohenjodaro; and though flooding and consequent abandonment of the site at that period may account for the lack at the latter place, it is obvious that

¹ *Vide* fig. 2, page 25, 'The Aryans' by Prof. Gordon Childe.

² For illustrations of (b), (c) and (d) see *Illustrated London News*, November 1936.

³ *Vide* text fig. 2. Mohenjodaro, some observations on Indian Pre-history, *Iraq*, Vol. VII, pt. 1, 1940, by M. E. and D. H. Gordon.

these terms have only very local application as they are also inapplicable to the pottery of Makran or the Zhob.

The sum total of these trifles is not to be ignored, if indeed they are as trifling as some appear to consider. In any case objects have been shown to exist which indicate that there are a number of definite survivals from the pre-historic to the early historic period. The important point which follows unquestionably from this basic fact is that if they are survivals they must be connected. Objects have also been shown to exist which in our opinion indicate quite clearly that the apparent blank hiatus is only the result of inadequate research. 1

Up to date the chronological yardstick of the Early Historic Period has been the successive types of stone statuary, their treatment and their ornament, about which there can be but small differences of opinion, such as whether the large early Yakshas are really Mauryan or post-Mauryan, and whether the Buddha image of Gandhara is older than that of Muttra. The measure for the pre-historic period is derived solely from links with the early chronology of Iraq. At any rate both these periods have a basis of fact for any chronological arguments advanced; this is not so in the case of the hiatus. Here we find that the measure is the period of time which various pundits and philologists consider must have elapsed for the production of certain scriptures and the development of certain religious ideas. Added to which are some notable speculations, such as whether the pole star was sufficiently in evidence at some not very well fixed period, for it to be taken as an image of constancy. All such fantasies, including the arrival of the Vedic Aryans from the North Pole about 30000 B.C. and their existence in another Yuga when the Universe presented a different aspect, are profitless conjecture. The truth is that so far as India is concerned we have no measure for this period and but very few facts on which to form one.

The Indo-European names found in the archives of Boghaz Keui and 18th Dynasty Egypt have only the vaguest value in determining the period and progress of the Aryan occupation of Northern India; for Vedic India is by tradition Northern India, and it is there that search must be made to fill the gap in our knowledge. So far nothing has been done which has yielded very concrete results, a summary of this material, real or hypothetical as has yet to be determined, may prove to be of some interest. Firstly, there are the few objects which we have mentioned above as being almost certainly of middle second millenium date, found for the greater part in the upper levels of pre-historic sites, those first eight or ten ambiguous feet. To these may be added the copper and bronze objects put forward by Heine Geldern in his article, namely the Truncheon Axe from the Kurram, the Punjab Dagger, the Bithur Dagger and Harpoon head, the Fathegarh Swords and the Rajpur Harpoon,

all of which together with the Mohenjo-daro Adze-axe he refers to the period 1200-1000 B.C. Besides these there are only the ancient walls of Rajagriha, the 'Vedic' burials of Lauriya Nandangarh, the punch-marked coins, the various terracottas which from time to time have been loosely classified as Primitive and Pre-Mauryan, a good deal of painted pottery about which so far but little is known, and the somewhat meagre knowledge we possess of the ancient sites of the Punjab and the N.W.F.P.

For the Walls of Rajagriha and the Nandangarh burials a date of 800 to 700 B.C. is claimed, which may prove to be correct in the case of the former, but the mounds of Lauriya Nandangarh have been examined by Mr. N. G. Majumdar; four of them were cleared of earth until the underlying structures were revealed, these proved to be Buddhist stupas possibly of early date. The gold leaf female figure, thought by Bloch to be an Earth Goddess, came from a trench on the top of this recent work and is therefore not of Vedic date and probably Post-Mauryan. I have purposely omitted any reference to the Megaliths and Cairn burials of Southern India and Hyderabad, as I consider that the North is the region where links must be found if they are to carry conviction. The Megalithic remains of the North, Burj Hama in Kashmir (*Antiquity*, June 1937) and Asota in the N.W.F.P. (*Antiquity*, December 1939), afford but little help. The former is extremely 'sui generis' both as regards the monument itself and the remains which have been excavated there. The latter may well be of no very great antiquity and at the moment there is nothing available to support a contention either way.

Punch-marked coins we feel need to be handled with caution. It is undeniable that many if not the majority of the symbols on them have their counterparts in the Indus Valley script. These symbols are therefore almost certainly survivals, but after what lapse of time, that is the question. Here we need to go warily, for in quite early literature these coins are known as 'purana' and that is quite sufficient for many Indian archaeologists to date them back indefinitely. To us it is plain however that the term purana (ancient) is of exactly the same value as when the present day owner of a battered Moghul copper coin tells you that it is a Sita-Rami, nine hundred lakhs of years old, which merely means that in his opinion it is very ancient; that is to say, as proof of any particular dating the term 'purana' has no value at all. A very clear exposition of the evidential value of the punch-marked coins and their symbols is given by Dr. C. L. Fabri in his article 'A new branch of knowledge in India'.¹

The question of the Pre-Mauryan terracottas is still being worried out. So far not one single terracotta from any level of any site of the Early Historic Period can be shown con-

¹ *Indian Culture*, Vol. III, No. 1.

clusively, even by the unreliable method of archaeological dead-reckoning, let alone association with definitely dateable objects, to be of Pre-Mauryan date. As for the criterion of style, unless backed by conclusive parallels with material of known and accepted date, considerable familiarity with many hundreds of Early Indian terracottas makes us regard this method as on the whole worse than useless. The primitive and the archaic can again and again be shown quite conclusively to be the result of ineptitude and degeneration. Hellenistic Indo-Greek may turn out to be Hellenistic Indo-Roman of the early Imperial period when Greek art was 'the thing'. There are in fact a multitude of unappreciated pitfalls.

Of all the archaic terracottas those found in the Gandhara-Taxila area with applied and incised eyes are the most intriguing. They can now be shown as coming from fourteen sites in British India as well as others in Afghanistan and Tribal Territory. I cannot with propriety at this stage say more than that excavation at Sari Dheri¹ revealed such figures throughout the section from two feet to thirty-five below datum in the main mound, and at 40½ below datum and 9½ below surface at an adjacent point originally covered by the mound. As a Hellenistic moulded torso was found in the main mound at 37½ feet and a Menander coin at 32 feet² below datum, it is unlikely that anything found is older than 200 B.C. This, of course, does not rule out the possibility of finding them with yet earlier associations.

There is one point, however, that needs clearing up once and for all, and that is the possibility of these figures being in direct succession to those of Harappa and Mohenjo-daro. In point of fact, though it would be most helpful and convenient to believe otherwise, the figures under discussion have no real resemblance to those of the Indus Valley sites. In particular we wish to pin down this matter of applied and incised eyes. Though Mlle. Corbiau states, and we are sure and assured states quite accurately, in *Iraq*, Vol. IV, Spring 1937, that 'Dr. Mackay tells me that among the unpublished material of Mohenjo-daro this feature is quite frequent', the facts are however as follows :

At Mohenjo-daro out of 510 human figures examined by us not one had applied and incised eyes. The example quoted by Mlle. Corbiau was noted and is a bearded head broken almost certainly from a man-headed animal. Of the man-headed animals, out of 61, four have applied and incised eyes, and one applied and indented. At Harappa out of 673 human figures

¹ Excavation was carried out at Sari Dheri during May, and October to December, 1938, by Mille. Simone Corbiau and Mr. Mukerji of the Archaeological Department. The results have yet to be published.

² As Kushan copper coins were found down to this depth the Menander is we feel a survival in a higher level than its true context, and it is probable that some of the square copper coins unearthed between 32' and 42' B.D.L. will be found to be Saka issues.

examined one had applied and incised eyes, and of the 13 man-headed animals, two only had this feature. This disposes finally and definitely of this convention being a survival characteristic of the pre-historic period.

Another point may also be touched on in passing, and that is that there is one figure only from both Harappa and Mohenjo-daro which has the smallest resemblance to the pre-historic female figures found at Periano-Ghundai and other sites in the Zhob. The latter are of fragile creamy white clay, and the ornaments, eye forms, headdress and general style of modelling are all totally dissimilar from the Indus specimens. The same lack of similarity being found in the painted pottery types, this material should be used with the greatest caution when looking either for the origins or offshoots of the Indus Cultures, both in time and space.

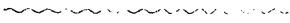
It would be rash to deny that none of the terracottas found at sites other than those containing remains of the Harappa Period is of Pre-Mauryan date, but none of them is demonstrably so. The Archaic types from the Frontier Province and Taxila and those from Muttra cannot be dated higher than 250 B.C. and it is unlikely that any of them are earlier than 200 B.C. The terracottas from Kosambi fall in line with those from Muttra, and the earliest types from Bhita and Basarh may possibly be Mauryan but are certainly not Pre-Mauryan. The material from Buxar has been treated in such a way that it is quite impossible to make head or tail of anything connected with this site.¹ The female figures with moulded faces appear to be Sunga and the primitive type with directly incised diamond-shaped eyes and small pursed-up mouth can be paralleled from Taxila. The alleged Pre-historic and Sumerian connections will need to be supported by the results of scientific examination before they can receive any serious consideration.

Surface investigation of sites is, to say the least of it, inconclusive. At the same time certain observations made in this way may be of some small value. The bluffs above the Soan River in the vicinity of the Attock Oil Company's Works are an example and a warning; here on the surface may be found any number of quartzite artifacts, a very few chert microliths, pottery of the Buddhist Period, and painted pottery, some of which may be as early as the 1st or 2nd Cent. A.D., but most of which is almost certainly modern. A site near Taxila produced one very finely struck micro-core of chert; wide and careful search failed to produce further traces of this material. The site yields plenty of painted pottery, all of it

¹ Remains of a Pre-historic Civilisation in the Gangetic Valley by Dr. A. Banerji-Sastri in the K. B. Pathan Commemoration Volume. The references in the text have no relation to the numbers on the very indifferent plates. The text is modelled very closely to that of A. K. Coomarswamy's article in *Ipek*, 1927.

dated to the early centuries A.D. if not later. The Akbar mound near Gūgera, Montgomery District, about thirty miles from Harappa, though a vast mound with deep eroded channels in it, does not show a single sherd of Harappa type, though there is plenty of pottery, including painted pottery, of Buddhist, Mediaeval, and Mohamedan times. At Harappa however unmistakeable 'Harappa' types are in profusion both on and close to the surface. At first sight this does not appear to get us anywhere, but it does lead us to one important point. Painted pottery in India, without critical knowledge of patterns, shapes, colours, slips and texture, is quite meaningless, and even the presence of an odd chert flake does not make a pre-historic culture. We were under the impression that the word chalcolithic indicated the co-existence of stone and bronze implements, yet sites have been called chalcolithic simply on the strength of some painted pottery almost certainly of the historic period and not necessarily the early historic period at that.

Enough we hope has now been said to show that a blank hiatus of two thousand years in Indian culture does not exist, and at the same time give some tentative indication of the links available, and the pitfalls that await the investigator over this line of country. It is to be feared that it will be possible to add but little to this until there has been more and better digging.





1



FIGS. 1 & 2. Pedestal Type Birds. (1) From Harappa (2) From Bala Hissar.



3

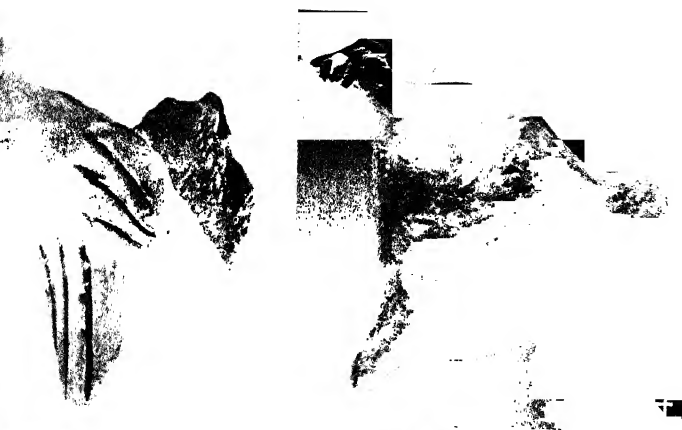


FIG. 3. Bird whistle from Harappa.

" " Bird rattle from Taxila.

" " Hellenistic Head with fan-shaped headdress, Taxila.

(Figs. 4 & 5 published by the courtesy of the Archaeological Survey of India.)



FIG. 3. Divided Terracotta figurine from Bala Hissar, Charsadda.

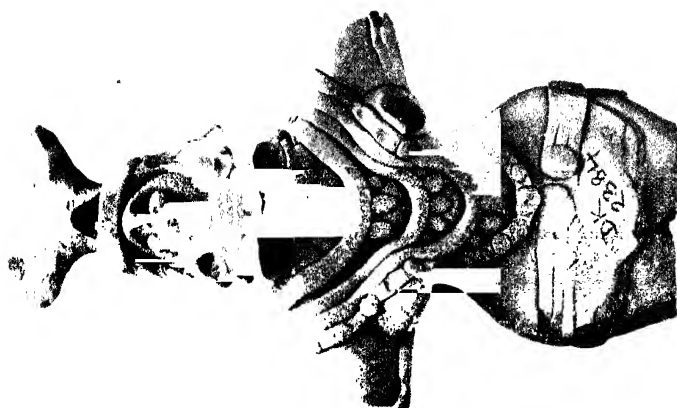


FIG. 2. Female figurine with fan-shaped head (dress, Mohenjo-daro. (Published by the courtesy of the Archaeological Survey of India.)

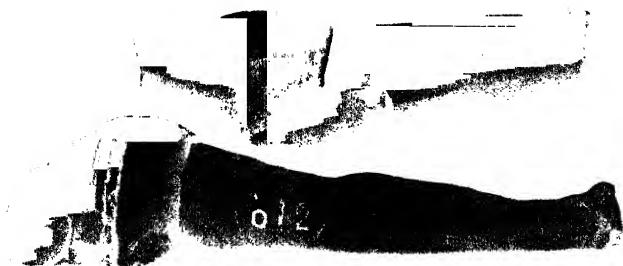


FIG. 1. Divided Terracotta figurines from Harappa.



FIG. 1. Potsherd with peacock design, Akhkari Dheri, Risalpur.

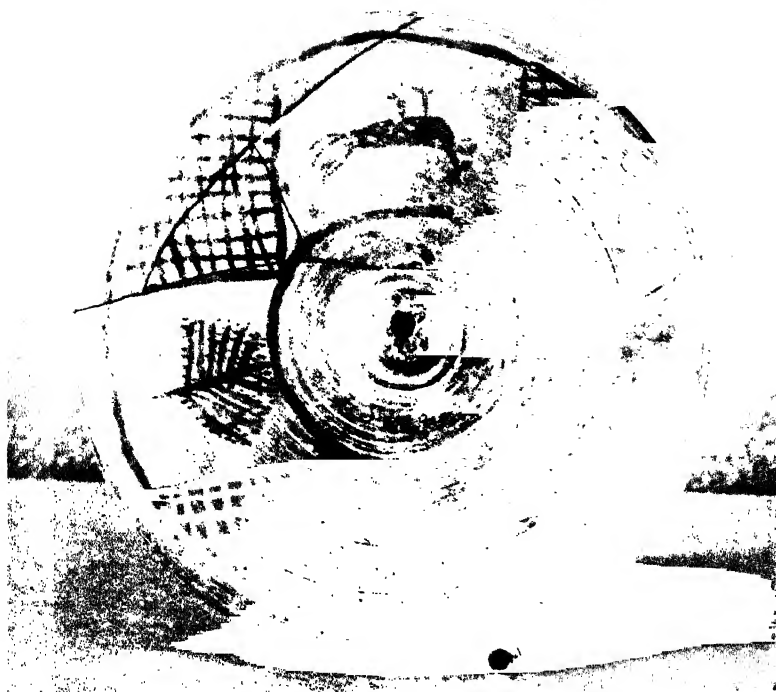


FIG. 2. Pot lid with peacock design, Taxila.
(Published by the courtesy of the Archaeological Survey of India.)

**Some Observations on Two Copper-plate Grants from
Bhāṭerā, Sylhet District, Assam.**

By UMESH CHANDRA CHAUDHURI.*

(Communicated by Mr. J. C. De.)

About the Bengali year 1279 (1872-73 A.D.), two copper-plate inscriptions were found on a hillock in a village known at present by the name of Bhāṭerā in the District of Sylhet, Assam. This village lies at the eastern foot of a small hill, extending north and south from Maurāpur on the southern bank of the Kuśiārā river to the northern bank of the Manu, and spreading over an area of about twenty miles in length and between three and five miles in breadth, interspersed with several small hills about fifty to two hundred feet high, all covered with dense jungle.

Along the eastern side of the hill (known in the records of the Forest Department as the Bhāṭerā Hills) and just by the side of the Sylhet-Kulaurā branch line of the Assam-Bengal Railway, between the mile-posts $2\frac{1}{5}$ ³ and $2\frac{1}{9}$ ³ lies what was to all intents and purposes a deserted hill-fort, with brick-built stairs to reach the level of the fort. At the present moment however there remains little of what must once have been a magnificent structure.

In the Bengali year of 1279 (1872-73 A.D.), a local zemindar, the late Babu Kāśī Chandra Chaudhuri arranged to collect old bricks from the above-mentioned fort for some constructional works in his house. One of his men employed on the task, came across the two copper-plates, placed one above the other, in course of digging. Some five or six years later, after the death of Kāśī Chandra, the plates passed into the hands of his youngest brother, Babu Jagat Chandra Chaudhuri. Facsimile impressions of them were sent to Dr. Rajendra Lala Mitra, the then Secretary of the Asiatic Society of Bengal. The inscriptions were transcribed by Panditā Ramā Bāi and her brother Śrīnivāsa Śāstri and the whole was published by Dr. R. L. Mitra with a short note, English translation and facsimiles in the *Proceedings of the Asiatic Society of Bengal* for August 1880.

The plates are now preserved in the Archaeological Section of the Indian Museum, Calcutta.

* The author expresses his gratitude to Mr. R. K. Ghoshal for kindly revising the paper.

As has been said already, it was Dr. R. L. Mitra who published a comparatively full and critical edition of the two grants. These were next discussed by scholars like the late lamented Pandit Padmanath Bhattacharya and Dr. K. M. Gupta in the periodical press of Sylhet and Calcutta. Dr. Gupta further re-edited one of the plates (that of Keśavadeva) in the *Epigraphia Indica*¹.

In the present paper I have endeavoured to discuss the two records afresh in the light of such local and topographical knowledge as I have been able to collect by a long and continued residence in the District of Sylhet very near to the find-spot of the inscriptions concerned.

Locality.—As we have stated above, the plates were discovered from the ruins of a fort on a hillock or *ṭilā*. The hillock is about 150 feet high, the highest level portion measuring about 400 feet from east to west and about 200 feet broad from north to south.

The eastern side of the hillock has even now distinct traces of extensive long and broad stairs made of bricks. These stairs, commencing from the upper portion of the hill-fort, go down to the bank of a tank which is about 600 feet long and 300 feet broad. The tank at present goes by the name of Sātpāḍi Pukur (i.e. 'tank with seven banks'), whatever that may imply. The Sylhet-Kulaurā branch line of the Assam-Bengal Railway runs by the western bank of this tank separating it from the stairs-system of the hill-fort referred to already. There are traces of another old tank a little to the north-west of the hill-fort which now passes under the name of Baḍa Pukur ('the big tank') and which is about four times larger than the Sātpāḍi Pukur.

The southern and western sides of the hillock permit an easy access, but the northern side is steep and difficult to negotiate. Considering the enormous extent of the ruins on the hill, it may well have represented the royal palace of the kings of the Bhāṭṭapāṭaka line.

Towards the north of the palace or hill-fort, within half a mile, there is a smaller hillock which goes by the name of *Homer ṭilā* (i.e. the mound for the performance of *Homa* rites). At the foot of this *ṭilā*, there is a tank about 150 feet long and 90 feet broad. The *Homer ṭilā* is about 50 feet in height and approximately 100 feet in length and breadth, though not exactly squarish in shape. At the central part of the upper portion of the hillock, there was the sacrificial pit (*Homa kuṇḍa*) built of the same type of old red bricks. The pit itself was 3½ cubits in length, breadth and depth.

About two or three furlongs to the north of the *Homer ṭilā* we come to what are called the Darbārī *gul* and the Darbārī

¹ Vol. XIX, pp. 279 ff.

ṭilā. The latter stands in the centre of a plain. It is about 20 feet high, 90 feet long and 60 feet broad. Here the royal personages of Bhāṭṭapāṭaka would seem to sit with their officers in a position overlooking the multitude that would gather over the extensive plain. The very appearance of it points to the probability of its having been a very suitable place for holding royal *darbars*. By the north and south of this plain run two small streamlets: The one by the north side has dried up long since, but the southern stream which now bears the name of Phulchhadā is still active.

About a mile off, to the east of the Darbārī *ṭilā*, are the Dakṣiṇā *Kāndi* and the Dakṣiṇā *bil* to the east of which is the great Hākāluki *haor*. It was perhaps at this spot that King Keśavadeva performed the Tulāpuruṣa *yajña* referred to in the smaller inscription and distributed *dakṣiṇā*.

The plates and their purport.—Both the grants are records of gifts of land, houses, slaves, etc., to two household deities, probably of the royal family. The earlier and larger of the plates records a gift of 375 *hālas* of land, in 67 plots and 51 villages, scattered over the sub-divisions of North and South Sylhet, Habiganj and Karimganj and also partly in the plains of the Cachar District. Along with this land 296 houses and a number of slaves were given away in the name of Vateśvara Śiva by king Keśavadeva. Vateśvara Śiva has been mentioned as 'the Lord of Śrīhaṭṭa' (*Śrīhaṭṭa-nātha*) in whose honour Keśavadeva built and dedicated a number of temples.

The latter and smaller plate is a gift of two *hālas* of land to Kamalākānta Nārāyaṇa by King Īśānadeva, son of Keśavadeva, the donor of the earlier grant. Dwelling houses and fields included within the area were also given away to the deity and a lofty temple was built for Nārāyaṇa or Viṣṇu.

As regards the dates of the inscriptions a number of suggestions have been offered. The date on the earlier plate begins with *Pāṇḍava-kulapāl-ābda* followed by four numerals. Paṇḍitā Ramā Bāi and her brother Śrīnivāsa Śāstri read them as 2928, while according to Dr. R. L. Mitra it stood for 4328 corresponding to 1245 A.D. The latest reading is that of Dr. K. M. Gupta who puts the date at 1049 A.D.

We may now proceed to an examination of some of the interesting facts elicited by the records under discussion. For purposes of convenience, we have preferred to deal with the several points at issue under the following heads:

(i) *Alleged connection of the Bhāṭerā group of kings with those of Cachar and Āgartalā.*—There has been some inexplicable unanimity of views among some of our scholars on this particular point¹. The Bhāṭṭapāṭaka kings have long been

¹ See e.g., *Proc. A.S.B.*, August, 1880, p. 144; *Ep. Ind.*, vol. XIX, pp. 280 ff.

regarded as sovereigns of Cachar, the founder of whose dynasty is traditionally supposed to have been Ghototkaca, son of Pāṇḍava Bhīma by Hīḍimbā, daughter of an aboriginal chief. As a matter of fact however, the available data point to a quite different conclusion: The people who now go by the name of Cacharis were originally settled in the Brahmaputra valley. Driven by the rising Ahom rulers, they betook themselves to Dimapur about 1531 A.D. Being still hard pressed by the Ahoms, they moved on to Maibong and thence finally to the vast plain of Cachar where they established their new home. They were essentially a community of uncultured hill-people having absolutely no alphabet whatever and as yet entirely uninfluenced by Sanskrit culture. It was in fact not till after the 16th century of the Christian era that the people of Cachar were converted into Hinduism and it was about this period that the legend of a Pāṇḍava extraction of their kings was concocted to keep up their pride.

It will thus appear that the dynasty of the kings of Bhaṭṭa-pāṭaka and those of Cachar were far too separated from each other in point of time—by three or four centuries to be sure—to allow us to accommodate any theory as to their being mutually related.

As regards the Āgartalā kings, it is well-known that their dynasty originated from the Shān States of Northern Burma and their family title was originally the inconspicuous *Phāñ*. They entered Assam for the first time in 1228 A.D. It was about the first quarter of the 14th century, that some branch of them crossed the North Cachar Hills and passing the Lushāi and the Chittagong Hills, settled itself at Āgartalā¹. This branch was converted to Hinduism in the 16th century, i.e. about the same time as that of the kings of Cachar. They now changed their original family title of *Phāñ* into *Māṇikya* which is current to this day. It seems therefore unlikely that the kings of the Bhāterā plates² had any family link either with those of Cachar or of Āgartalā.

What however looks more reasonable is to surmise that the kings mentioned in the Bhāterā inscriptions were a group of chiefs who wielded some influence in the country representing the modern district of Sylhet. This dynasty continued apparently for five generations after which it became extinct. Possibly it was only a result of the oncoming Muhammadan invasion of the country. Or it may have been that the last

¹ For the origin of the Cachar and Āgartalā kings, see E.A. Gait, *History of Assam*, pp. 242-43 ff.

² From the nomenclature of the family titles and the names of the persons, as well as most of the place-names mentioned in both the copper-plates, it appears that the land was a part of Bengal and the persons were Bengalees.

member of the line—Īśānadeva—died without leaving an issue and the dynasty came to a natural end¹.

(ii) *Tradition of alleged association of the Iṭer ṭilā and the Homer ṭilā with king Gauragovinda*.—The whole question appears to us to hinge on a mistaken identification and also perhaps an unwarranted word-interpretation. In the earlier of the Bhāterā plates (that of Keśavadeva), the donor king is described (ll. 9-10) as *ripurāja-śoṣī-Govinda-ity=ajani Keśavadeva eṣaḥ*², which has been almost unanimously taken as pointing to there having been a second name, *Govinda*, of king Keśavadeva³. If one may hazard an opinion on this point, the explanations of this epithet offered so far seem to be quite strained. In fact the whole phrase could conveniently be broken up into two distinct but inter-related parts: (i) *ripurāja-śoṣī-Govinda-ity=* and (ii) *ajani Keśavadeva eṣaḥ*,—meaning that king Keśavadeva is here regarded as having been the equal in might of Govinda (Lord Kṛṣṇa), the destroyer of enemies. Such expressions, as will be readily admitted, represent but a common epigraphic and literary convention of the age to which our record belongs.

It has further been assumed⁴ that the ruined mound called Homer ṭilā marks the spot where king Gauragovinda (*alias* Govindasimha) used to perform sacrificial rites. This assumption is of course a corollary to the supposition that Govinda is only another name of Keśavadeva. The explanation suggested by us, if accepted, will surely help to dispel such a notion. It should also be taken notice of that Gauragovinda of North Sylhet was conquered by Shah Jallal in 1384 A.D.

¹ It appears however from the later inscription (No. II, *Proc. A.S.B.*, August 1880, p. 153, ll. 25-28) that Īśānadeva had a childless elder brother (*sthavirah putraśūnyaḥ*, l. 27) and that he had another brother who pre-deceased him leaving a widow and a son. No record has yet been discovered of this fatherless child. Perhaps even before he grew up to manhood the whole country was engulfed by the Muhammadan invasion.

² In the inscription of his son Īśānadeva, Keśavadeva is referred to (ll. 8-9) in almost identical terms, *viz.* *ripurājā-śoṣī Govinda-vīro . . . etc.*

³ *Proc. A.S.B.*, August 1880, pp. 144, 151n; *Ep. Ind.*, vol. XIX, pp. 279 ff.

⁴ *Proc. A.S.B.*, August 1880, p. 144.

The Ancient Workers of Western Dhalbhum.

By E. F. O. MURRAY.

(Communicated by Dr. B. S. Guha.)

The Dhalbhum pergannah, which forms the most easternly portion of the Singhbhum district of Chota Nagpur, has long been noted for the multiplicity of ancient workings that occur therein. It has an area of nearly 1,200 square miles through which the copper belt runs roughly south-east to north-west for a distance of over 50 miles, quite half of which must be covered by old workings when parallel lines are taken into consideration. In addition to the copper workings the ancients have worked gold, both alluvial and quartz, in the southern and eastern portions, and soapstone, while numerous small heaps of iron slag are to be found scattered all over the pergannah wherever the ore occurs; the refuse of the local iron smelters, which industry still exists in the remoter parts up to the present day.

On its eastern border is the Midnapore district and the States of Mayurbhanj and Seraikela bound it on the southern and northern borders, while in the centre comparatively level or undulating country predominates, divided by the range of hills that follows the copper belt over the greater portion of the pergannah. The inhabitants of Dhalbhum consist mainly of Santals, Mundas and Bhumij with a sprinkling of Hos and Kherrias, all members of the group that must have been in possession of the greater part of Northern India in pre-Aryan days. Among the semi-Hinduized castes may be mentioned the Goâlās (cowherds), the Kumhārs (potters), the Kammārs (blacksmiths), the Perehs or Tāntis (weavers) and the Mahles (basket-makers), the last four being essential to the existence of village communities. The Santals, Mundas and Hos all speak languages belonging to the Mon-Khmer group of the Austric languages of which Pater Schmidt found relics among the forest tribes of Pegu, Malacca and Indo-China, and along the middle Salwin, the Nicobars, and part of the Philippines and Oceania.

Ethnologically the Santals, Mundas and Kols all belong to the Proto-Australoid family which is widely distributed in Southern Asia and the Oceanian islands. Risley in his measurements of the various tribes obtained the following indices:

	Cephalic Index	Nasal Index	Stature
Munda (100)	74.5	89.9	1446
Santal (100)	74.5	88.8	1510
Kol (32)	72.4	82.2	1650

The specimens of the last, however, are stated by him to have eastern Hindi as their tongue, to live in the United Provinces, and to be of Aryo-Dravidian type. This cannot be taken as typical of the Kols of the Kolhan of Singhbhum whose language is allied to Mundari and Santali and with whom they have similar physical characteristics. Both the Mundas and Santals have legends about migrations from the west before the Aryan invaders, in times when Indian history was confined to legends; and in the *R̥g-Veda* frequent mention is made of the *Dasyus* or *Savaras*, the Aryan names for the original inhabitants of the country. Both Kolarian and Aryan traditions point to these tribes as having extended further to the north-west prior to the invasion and to having been gradually driven into the more southern and eastern hills as the Aryan invaders fought their way towards and down the Gangetic plain.

Roy¹ has traced the wanderings of the Mundas by their traditions and pointed out that many of the names of the enemies of the Aryans, mentioned in the *R̥g-Veda*, are to be found among the Mundas and allied tribes at the present day,—evidence that the writer is able to corroborate from further examples. That the aboriginal races were not mere savages is evident from the accounts of their organization, strong-built cities and forts which gave much trouble, while their wealth proved a source of envy to the invaders. From *Āzamgarh*, now in the United Provinces, Munda tradition commences, so it would appear that they must have remained for some time in this district, an assumption that is supported by Hindu tradition. By the reign of *Rāma Chandra* of *Ayodhya* the *Raj-Bhars* appear to have been the only tribe left at *Āzamgarh* and before the departure of the *Savaras*, or *Asuras* as they were then called, both Hindu and Munda traditions record a deluge. Gradually they continued their eastward march before the increasing hordes through *Bihar* into *Chota Nagpur*, but from their later temporary sojourn in *Rohilkhand* and further west the invaders would appear to have met with some reverses and the native races to have regained some of their terrain. This change of tide in their fortunes would seem to be confirmed by sepulchral cairns existing near *Nagar*, and attributed to the aborigines, representing two distinct stages of culture. In the first only stone implements and rough pottery are to be found, while the latter contains iron weapons and gold and copper ornaments.

The earliest foreign reference to the use of iron in India appears to be the description in *Herodotus*² of the Indian mercenaries in *Xerxes*' army in 480 B.C. who were clad in cotton garments and armed with bamboo bows and cane arrows with

¹ Roy, S. C.—*The Mundas and their Country*, Chap. I, 1912.

² *Herodotus*, VII, 65.

iron tips, which with the addition of axes form the complete armament of the aborigines in modern times.

The Hos, or Kols, appear to have occupied Chota Nagpur from pre-historic times though they are reputed to have at one period ousted the Bhuiyas from Singhbhum and to have settled there, where the majority of them now are. Their prowess in the field earned them their name of Lerrka (fighter), by which they are known to the other tribes at the present day, and in their encounters with the British fully sustained their reputation until they realized that axes, bows and arrows could not seriously compete with firearms and cavalry.

Pliny in *Hist. Nat.*, quoting from Megasthenes, states that 'The tribes which dwell by the Ganges are the Calingae nearest the sea and higher up the Mander; also the Malli among whom is Mount Mallus, the boundary of all that region being the Ganges'. Mount Mallus is probably identical with Mount Mandar of the Vedas which lies near Bhagalpur and the Malli with the Mahle Paharias who occupy the Rajmahal Hills. The Calingae were the inhabitants of the kingdom of Kalinga, or Orissa, which, with lapses, preserved its independence from the earliest times until towards the end of the eleventh century A.D. when Kulottunga I added it to his dominions. That the Kolarian tribes were in this region in the sixth century B.C. is proved by records of the travels of Vardhamāna Mahāvira who was the twenty-fourth Tirthankara and main founder of the Jain religion in which it is stated that 'he traversed the country occupied by the Bajra Bhūmi and Sudhi Bhūmi (the modern Bhumij) who abused and beat him and shot at him with arrows and barked at him with dogs, of which small annoyance he took no notice'.

As a detailed account of the geology of the district does not come within the scope of this paper this subject will be dealt with as briefly as possible. Singhbhum is composed mainly of Archaean rocks. In Dhalbhum the Dharwar complex is represented by lava flows in various stages of metamorphism, phyllites, slates, talc, hornblende and micaceous schists and quartzites. This period was followed by intrusions of granitic batholiths, which in their turn were invaded by doleritic dykes of varying basicity, whose extent is generally limited by the perimeters of the acid intrusives. The Dharwars are the main seat of the Indian metalliferous ores, most of the gold, copper, iron and manganese produced in the country being connected with them. Copper, having been the cause of by far the greatest proportion of the ancient and more modern workings, this will be dealt with first.

The Singhbhum copper belt, which starts from 5 miles north of Chakradharpur in the west and runs through the States of Kharsawan and Seraikela, enters Dhalbhum between the villages of Keryuadungri and Rangadih where old and

more recent workings show three more or less parallel runs of ore. Further east between Talsa and Nandup and on Chandar Buru these veins have been extensively mined by the ancients, and in more modern times by the Singhbhum and Hindustan Copper Companies, of whose activities Stoehr, Durrschmidt and Schenck have left records.¹ On Chandar Buru old workings are very numerous on three lines of ore: while extensive old workings occur between Talsa and Turamdih on the southern line; on the centre and southern lines near Sideswar, to be described later, and others further east beyond the limit of this article at Surdah and Mosaboni. It is on the last of these that the Indian Copper Corporation has developed its Mosaboni Mine.

On Chandar the ancients were well clear of the water-line as the summit of the hill is about 700 ft. above the surrounding country and most of the ore occurs near the top. Old ventilation shafts are to be found on both the northern and centre lines, the latter being circular and about 3 ft. in diameter by 20 ft. deep to the debris in the bottom above the stope level, while the dumps from all three runs of workings are considerable. From the numbers of palaeoliths, bouchers and neolithic cores, flakes and beads occurring in the neighbourhood, this would appear to have been one of the earliest points of attack of the ancient miners, and the wreckage of trap implements in the dumps leaves no doubt about the extraction of copper having been started with their aid. As plenty of iron ore exists close at hand one can only assume that the use of this metal was not then general. Between Chandar Buru and Hartopa there are no prominent hills along the line of belt and old workings are confined to sundry ridges that rise out of the plain, but from the latter to Rajdoha they are fairly extensive on both sides of the Garrha River which cuts across the strike at right angles. From Rajdoha, where three inclined and one circular vertical shafts have been sunk and one adit driven in modern times, old workings are scarce until close to the Kapurgadi Pass where considerable runs occur on the hills on both sides. The easternly run of these is continued to Rakha Hill and was included in the area worked by the Rajdoha Mining Company towards the end of last century. On Rakha Hill old workings are numerous and can be followed until they run up on to the spurs that connect the northern side of Sideswar with the lower country. Here as at Nandup and Chandar three parallel runs are found: the most northerly follows the crest of the spur south-east of Roam; the centre, which is the most important, the flank of the next ridge to the south, while the third is below Sideswar itself. This last consists of an open stope running from the valley into the side of the hill and connected some way in by a steeply inclined circular shaft

¹ Gold, Copper and Lead in Chota Nagpur, W. King and T. A. Pope.

of about 4 ft. in diameter to the ground above. The top of the ore shoot being flat this was soon below the surface of the rising ground and the shaft must have been sunk for ventilation, though the steps cut in it permitted its use as an emergency exit. The northern line was explored by an adit started from the valley by the Cape Copper Company, which had taken over the assets of the Rajdoha Mining Company in 1912, but on holing into a very extensive ancient stope and meeting with runs of filling or fallen rock, both above and below the adit level, suspended this work. The height of this stope was probably little short of 150 ft. and of undetermined length, but the only things of interest produced were some small baked clay pots that had probably been used as lamps by the miners.

The only important source of gold hitherto discovered has been in the south-western portion of the pergannah close to the Mayurbhanj border. Here numerous trap grinding and crushing stones litter the jungle south of the village of Kundrukocha, with further small clusters over the hills in Mayurbhanj State. Isolated ones are to be found in most of the localities where blue or white quartz veins are available, proving that the ancients must have scoured the district in search of payable deposits. Numerous old workings have been found in various places around Kundrukocha and in 1913 the Dhalbhum Gold and Minerals Prospecting Company was floated in Calcutta to work this area. Its activities have already been described¹ so it is only necessary here to state that during the years 1916-1920 gold to the value of £25,000 was obtained, nearly all of which came from the Porojarna section. Most of the ancient workings follow pipe-like enrichments on folds, but in one case values of 2 ozs. over 30 ins. were obtained over a length of 80 ft. from quartz that did not outcrop and was thus missed by the old miners. The greatest depth so far known to have been reached by the ancients here is 97 ft. on a pipe coming down from the top of Porojarna Hill, and in the bottom of this were found a stone hand hammer and broken chisel.

Soapstone resulting from the metamorphism of trap is to be found in many places all over the pergannah, though by far the largest aggregate of workings exists on the hill to the west of Bhitara Dadi village, which rises to approximately 700 ft. above the plain. The rock varies in colour from light grey to bluish grey and is often traversed by streaks or stringers of magnesite, which spoil such parts for utensils without occurring in sufficient quantity to make their extraction an economic proposition. A large portion of the southern flank of the hill is covered by the spoil from the workings near the crest on that side, many of which are being exploited at the present day to meet the

¹ Gold in Chota Nagpur, E. F. O. Murray, *Min. Mag.*, Vol. XXVIII, No. 1, 1923.

demand for soapstone bowls and plates, and as this may be of interest, a description of the operations will be given.

The miner, having selected what he considers a suitable band of rock in one of the open-cast workings attacks this with an implement of local manufacture that is a cross between a pick and a hammer until he has cut a circular groove somewhat larger than the size of the article desired, that slopes from the inner side and is vertical on the outside. When he is satisfied that the groove is deep enough the next step is the removal of the piece from the rock, which is accomplished by the use of hammer and chisels. This is the most hazardous part of the process as owing to the uncertain fracture of the rock many pieces break otherwise than intended. Having overcome this stage he next gives the piece a rough dressing outside the working, after which it is put aside and mining continued. At the close of this the miner with the aid of his wife removes the roughly dressed blocks to the village where they are to be turned, to effect which a lathe of some sort is obviously necessary. In the ground are sunk two slats of wood with semicircular notches to take a wooden roller about $2\frac{1}{2}$ ft. long, to one end of which the plate is stuck by means of lac, two grooves on the roller running in the notches preventing lateral movement. The motive power is supplied by the wife who takes some turns round the roller with a piece of thin rope and holding an end in either hand imparts the necessary motion while the man with his cutter, a piece of iron or steel let into the end of a stick, removes the superfluous portions. The northern side of the hill is the one that was mainly worked by the ancients, though most of their dumps are now overgrown with grass and therefore inconspicuous. The old workings, which are here exceedingly numerous, generally commenced with the sinking of a roughly circular and steeply inclined shaft across the strata and, as good bands of the rock were intersected, stopes were opened out along them. The methods of detachment and treatment have not been determined, but probably did not differ much from modern times.

Remains of the ancient copper workers, as before stated, are exceedingly numerous, countless workings, dumps and slag heaps testifying to their industry. Below the largest of the old workings on the southern line between Talsa and Turamdih occurs the most extensive series of palaeoliths yet found by the writer, many hundreds of these being scattered over the ground at the foot of the hill and have the appearance of having been brought there for treatment. The rough fragments vary a good deal in size, untreated stones being mixed with broken ones and chips, but the general run desirable seems to have been 6 or 7 ins. by 3 to 4 ins. by 1 to 2 ins. thick and from these the implements were fashioned. The pieces are nearly all of a fine-grained trap and the actual source of supply

has not definitely been determined, though very similar rock occurs near Balidi about 3 miles to the south. Higher up in the dump from the workings further pieces and a few broken bouchers are to be found; some of a coarser grained material, but these are mostly small and in all probability mainly fragments of those that broke in mining. Above the workings are some flat rocks pitted all over to a depth of about 1 in. on which the ore must have received a crushing and picking before it was despatched to the smelters below, two crushing stones having been found close by. One of the pitted rocks has a hole about 5 ins. deep and 3 ins. diameter which may have been used for hulling paddy for the workers or for giving the concentrates a final crushing with a pestle for the furnace, but none has come to light in these parts. More recently, however, two broken stone pestles with circular polished handles that would fit a similar mortar have been found near Rakha Mines. Among the palaeoliths at the foot were two stone hammers and two pieces of roughly polished chisels, the former being made from waterworn pebbles of fine-grained trap that probably came from the Korkai River about 6 miles west of here and bear evident signs of chipping and hammering. Slag heaps and the remains of old clay furnaces lie all around and testify to a considerable output of copper at this point. Moving east the next places of importance on the south line are beneath some trees close to Turamdih village and the flat ground immediately west of the railway line, where most of the Turamdih ore must have been treated. Crushing stones consisting generally of flattish roughly circular pieces of trap, or occasionally quartz, with depressions to fit the fingers, are plentiful and some small slabs of pitted rock used as anvil stones lie around, while slag is abundant. Several ring stones have also been found in the neighbourhood. East of the railway line the first place of note is on some small hills close to the road on the northern line of ore where several traperushing stones of varying texture and a few anvil blocks are found. To the south of this the writer picked up a roughly smoothed axe-shaped piece of trap which from its chipped ends, one sharp and the other rounded, may have been used as a wedge. From here we come to Chandar Buru where the workings and remains have already been described. The flat rocks above the south line workings are pitted like those near Turamdih with a similar deep hole in one of them and the rejected material, showing malachite, lies around. Slag heaps and the remains of old furnaces abound all round the foot of the hill, while to the south-east is a place where hornstone and quartzite cores and flakes occur in profusion, not far from the banks of the stream which comes down from Dadi. Following the heaps of slag eastwards towards Goradi crushing and anvil stones occur with these, while not far from the banks of the stream on ground that has since been cultivated formerly

stood the remains of a battery of six old furnaces. The plan drawn from measurements taken before their destruction will

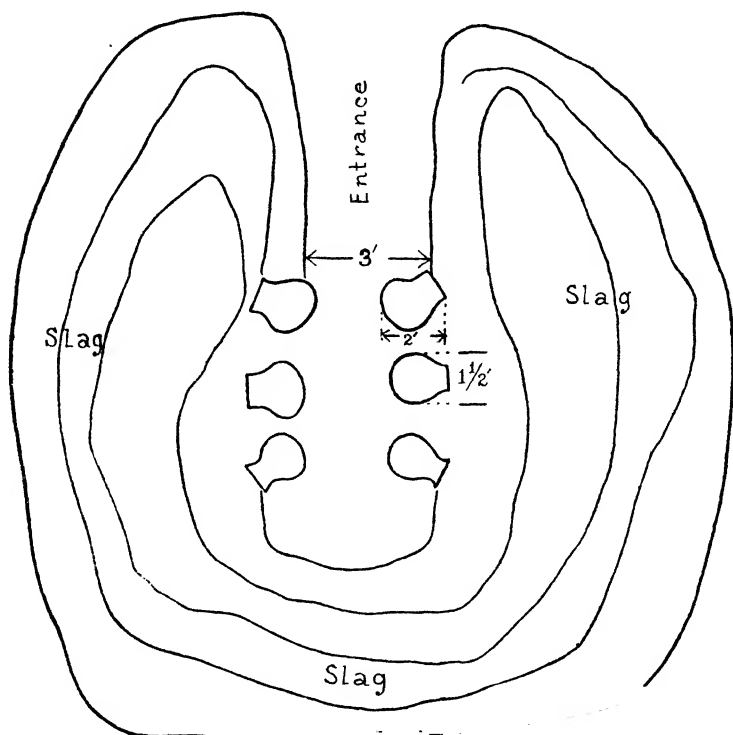


FIG. 1. Old Copper Furnaces, Chandar Buru.

show the layout, and a portion of one of the clay tuyeres remained on the ground. This was cylindrical, about 9 ins. long and 3 ins. in diameter with a pointed, slag-covered nozzle, the air passage tapering from about 1 in. to half an inch at the point. Only the hearths of the baked clay furnaces remained, 18 ins. wide by 2 ft. long, of the shape shown. Smelting must have been much the same as at the present day for iron, air being supplied from foot-worked leather bellows to clay furnaces about 3 ft. high. The bellows are rounded hollowed out blocks of wood open on the top over which a piece of hide is tied, while to the centre of the leather a cord is attached with the other end tied to a flexible stick planted in the ground, a hole being cut in the hide for the entry of air. A pair of these is placed side by side slightly sunk into the ground at a convenient distance for the operator's feet and air supplied by the bellows man marking time and closing the air vents with his feet on

the downward stroke while the spring of the stick raises the leather again as soon as the pressure has been released. A bamboo pipe taking off from each leads to a clay Y which joins the tuyere, one set being generally sufficient for each furnace though two are sometimes used. The blower's balance is often assisted by a sapling with one end sunk in the ground so that he can grasp the clear end with his hands.

The fire having been lit and charcoal blown up to a good heat the powdered ore is fed into the furnace with charcoal and in copper smelting either iron ore or kankar lime were used to flux the siliceous gangue. Considering the crude methods employed a remarkably clean slag resulted, but in two places where the ancients seem to have tried apatite-magnetite rock as a flux their metallurgy resulted in numerous small shots of copper remaining in the slag.

Immediately south of Goradi village is some stony undulating ground with spare vegetation, the knolls running towards the Dadi nallah. In a small hollow on one flank of the most easternly of these, just above a newly excavated tank, is a bed of solid laterite from 6 ins. to 2 ft. thick and about 60 ft. by 30 ft. in extent. A little way west of this bed three stones are stuck upright in the ground forming a rough line, the centre one protruding about 15 ins. and the other two 6 ins. each.

Both Hos and Mundas have from times immemorial been accustomed to mark their burial grounds in a similar manner by groups of monoliths, but these are as a rule anything from

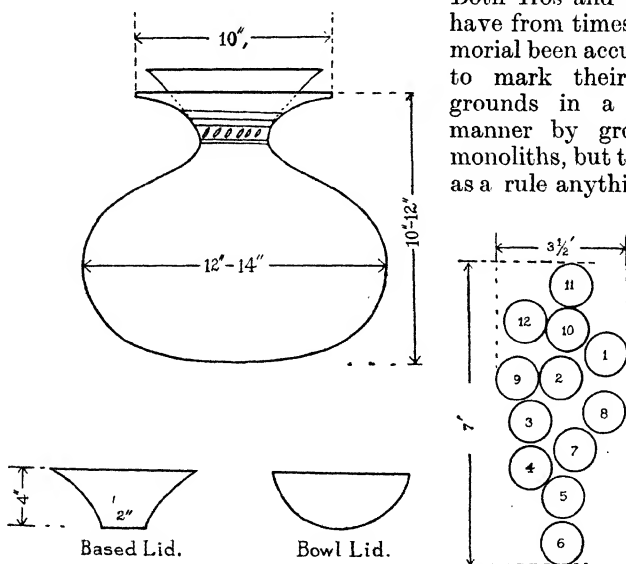


FIG. 2. Burial Urns, Goradi.

3 to 10 ft. high and large flat slabs of stone cover the earthenware pots that contain the remains of the bones of the dead.

These slabs may weigh anything from 1 to 15 cwt.; though heavier are known, the size generally depending on the amount of influence the deceased possessed. At the present day, however, many of the Mundas have deserted this method for ordinary burial, the corpse being covered by earth over which any large stones lying around are laid, while the 'parkom', or string bed with wooden frame, belonging to the deceased is placed upside down on the top.

An open hole in the ground near the three standing stones being unusual, an investigation was undertaken when this was found to be a cemetery presumably of the ancient miners. Though stone slabs are easily procurable in the vicinity none covered the urns and digging proved that these people had been in the habit of stopping the mouths of at least some of the pots with a small clay bowl. Altogether twelve clay urns were

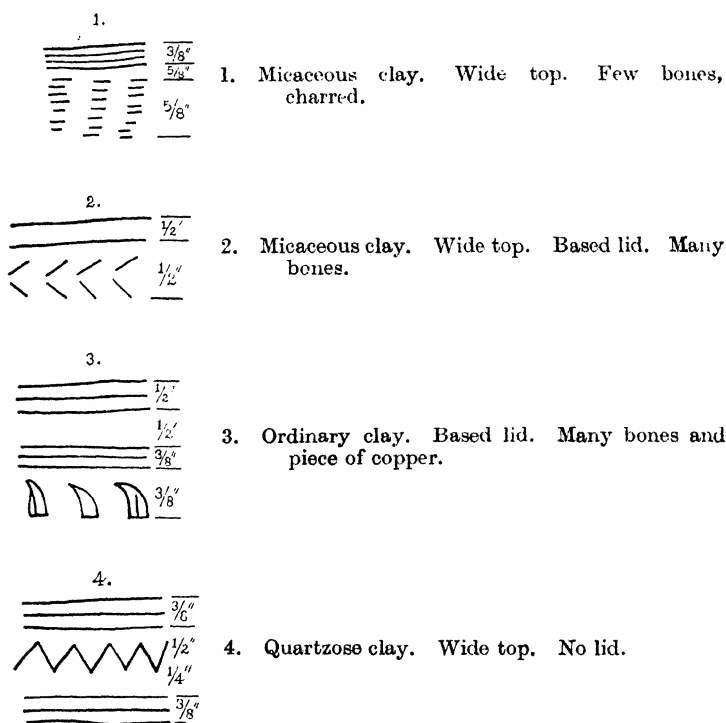


FIG. 3(a). Urn Neck Patterns (1-4).

extracted on the south side of the stones, from a plot about 7 ft. by $3\frac{1}{2}$ ft., in the hope of finding some relics that would give a clue to the times to which they belonged; but probably more exist here as well as on the opposite side of the stones.

The majority of the urns were made from a micaceous clay that seems to have been peculiar to the ancients and is no longer used, while the shapes and markings are more elaborate than at present. The pots varied in shape and size, being from 10 to

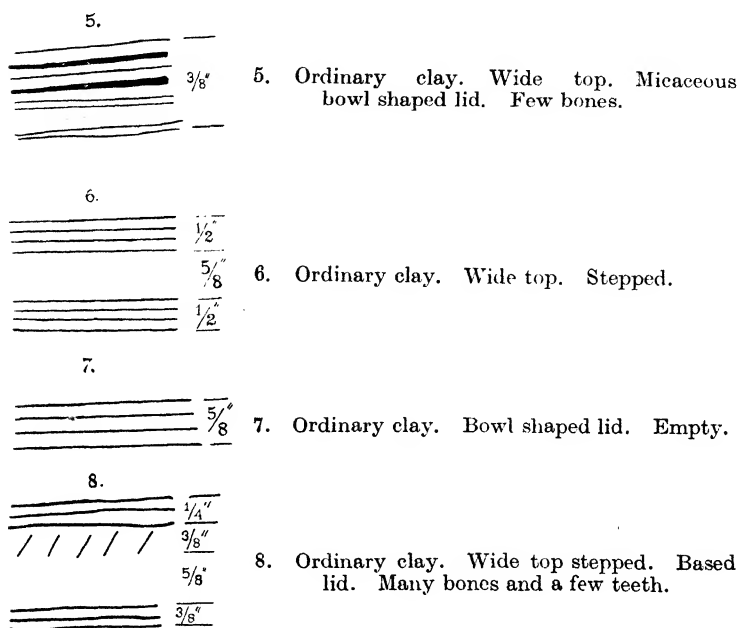


FIG. 3(b). Urn Neck Patterns (5-8).

12 ins. high and 12 to 14 ins. wide at their maximum, while the neck of each, which varied from 4 to 6 ins. in width, bore distinctive marks. Beyond broken bones, some of which seemed to be very slightly charred, some teeth and small pieces of copper oxidized to malachite, that may have been part of a chain, nothing was found. Owing to their broken state none of the urns could be preserved intact, but nearly all possessed widely turned back tops, while the small clay pots that filled the necks were of two kinds, one shaped like an ordinary bowl and the other with concave sides and a small flat base, the average size being about 8 ins. in diameter by 4 to 5 ins. deep.

A little way above the cemetery crushing stones of the usual type were fairly plentiful, while among them lay three neolithic celts and one flat stone about 15 ins. long by 7 ins. wide that had a groove caused by grinding. A portion had split off this stone at one end and both pieces had laterite attached to them along the sides of the crack. The nearest portion of the laterite bed is about 30 ft. away and there are

no means of ascertaining whether this has been formed since the ancients worked here or how far up the knoll it originally extended. Broken pieces of pottery lie about and in various places small heaps of slag, many pieces of which are cylindrical with

- 9.
-
9. Ordinary clay. Large teeth. No bones
- 10.
-
10. Micaceous clay. Ordinary clay. Bowl shaped lid. Some bones.
- 11.
-
11. Thick micaceous clay. Wide double lined top. Few bones and one bit of a tooth.
- 12.
-
- 12 Thin dark clay. Narrow single lined top with ledge. Few bones and teeth.

FIG. 3(c). Urn Neck Patterns (9-12).

vesicular surfaces and vary in size from about one inch to a quarter inch in diameter. Along with these are other pieces with semi-circular indentations which fit the cylinders, but the object and method of manufacture have still to be ascertained as well as the reason why such slag should be confined to this locality.

On the way from Kudada to Dadi, close to where the road crosses the railway line, occur two main lots and some scattered slag entirely different from the usual iron or copper slags of these parts. It varies considerably in colour, the greater portion being a light brown shading to the usual black, is porous and full of large cavities which look as though some crystalline

material formerly existing had since been leached out. In the darker material malachite stains are sometimes visible as well as long acicular crystals, which under the microscope are shown to be mullite. Both blue and white quartz veins occur in slate in this locality, while a tufa limestone deposit is found about half a mile to the west and small fragments of pottery with crushing and anvil stones are plentiful. For a long time the origin of this slag could not be determined until one day some years ago the writer was informed that beads had been made here in the distant past by a small old man who lived on Dhoba, the mountain above the village of Bonidi. Further enquiry elicited the information that they were sometimes found during the wet weather washed out of the ground and as the rains were then on, an immediate search was undertaken. The recently ploughed ground above the village soon produced some red and yellow beads, the former of which under the microscope proved to be made of a devitrified glass and the latter of terracotta, so the village children were put on to collect as many as they could. The result was that a supply started coming in and with the glass variety quite a number of polished stone ones. The majority of the composition beads are cylindrical and a brick red colour, varying in size from 13 mm. long by 6 mm. in diameter down to sections 5 mm. in diameter by 2 mm. thick, while some of the larger cylindrical pieces have been pressed flat before hardening and pinched near both ends, or cast to this shape. Nearly all the yellow beads hitherto found consist of sections which vary in size from 6 mm. in diameter by 2 mm. thick to 2 mm. in diameter by 0.75 mm. thick. Quite a number of blue and green beads also appeared, but these are generally roughly rounded and considerably more glassy than the others. The colouring matter of the blue and green beads is, as one would expect, copper, while an assay of the red devitrified glass ones gave results of 1.72% Cu and 1.68% Fe and the yellow ones also contained copper.

The stone beads are commonly made from carnelian, agate, onyx, or crystal either roughly rounded or flattened after the composition pattern, or faceted with eight or twelve faces, the last idea having doubtless been derived from quartz crystals. The largest bead is 23 mm. long by 16 mm. in diameter at the widest portion, diminishing to 6 mm. at the ends; while the rounded agate and jasper ones vary from 16 mm. in diameter. One quartz bead about 15 mm. long was shaped like a fang with a horizontal hole drilled through the thick end, while another one was a flattened hexagonal prism made of black hornstone and a third a cylinder of green epidote hornstone, both these rocks being establishable in the locality.

For threading, holes have been drilled from both ends and the alignment is frequently so faulty that these have scarcely met, the sizes varying from 1.5 mm. downwards. The means

and method of drilling have still to be ascertained, but supplies of kyanite-topaz-corundum rock are obtainable about 3 miles away, where a few stone implements have also been found. Lying among the relics of the beadmakers were two broken ringstones, one of a grit that occurs on the northern slope of the hills and the other of an iron-stained siliceous slate from the top of Dhoba Buru. Articles of baked clay were also found, the first a ball about 36 mm. diameter with a 6 mm. hole through the centre that served some undetermined purpose and a reel that probably once held the line on which the beads were threaded. Other items of interest were one white glass bead partially overlaid with beaten gold that had been stuck to the glass by lac, a piece of beaten gold lying in the soil and a portion of what looked like thick copper wire 40 mm. in length by 4 mm. in diameter. On cleaning up one end this was found to have a centre of red copper, an intermediate ring of black copper and an exterior of polished malachite. From the curve on it this may have been a portion of a bangle, or by cutting off slices and drilling out the red copper core it would have formed beads almost identical in shape to the smaller terracotta and stone sections. The only remaining article of interest was a pointed iron punch 75 mm. long and 20 mm. square, but of doubtful age.

The beads having been found scattered over the area it is impossible to say how they were strung in ancient times, but the greater portion of a necklace of col-de-chien length has been found with a burial urn and remains of bones near the village of Banabassa on the south side of Chandar Buru. This consisted of seven oblong and eleven rounded stone beads, nine flattened double-necked composition ones, one green one of same shape and one red cylindrical one 3 mm. wide by 5 mm. in diameter.

Stone beads of many types are recorded to have been found by Bruce Foote in Southern India, ascribed to Neolithic times, and on a comparison with those in the Madras Museum the writer has been able to find several similar to the Bonidi beads. Many neolithic beads seem to have forms common to both Europe and Asia, but the most striking discovery comes from a find from Montapalam in Pondicherry where the uncommon flattened barrel with lined ends shape occurs. A French authority¹ ascribes this type to Phoenician influence though the writer has hitherto only been able to find this form in beads from Mohenjo Daro and Ur and not among Phoenician beads in any museum visited.

Some years ago some rounded carnelian beads and a barrel-shaped onyx one were dug up at Kundrukocha not far from where the old gold workers' grinding stones are, and some of the

¹ Numa Laffitte—Rapport D'ensemble sur les Fouilles Exécutées dans le sud De L'Inde, Paris, 1932.

older men of the surrounding villages still have a few that have been picked up from time to time. More recently a trap ring-stone and various other stone implements have also been found in this locality, of types similar to those occurring on the copper belt and pointing to both the copper and gold workings having been made by the same people.

Following the copper belt eastwards, little of interest beyond old workings, occasional palaeoliths and cores and flakes, is to be found between Goradi and Rajdoha, or between this and Rakha Mines; but just beyond this last place on a spur that runs north from Sideswar we come to the ruins of Roamgarh, situated on the most elevated portion. This spur, which has a flat top, is exceedingly steep on all sides except where it is

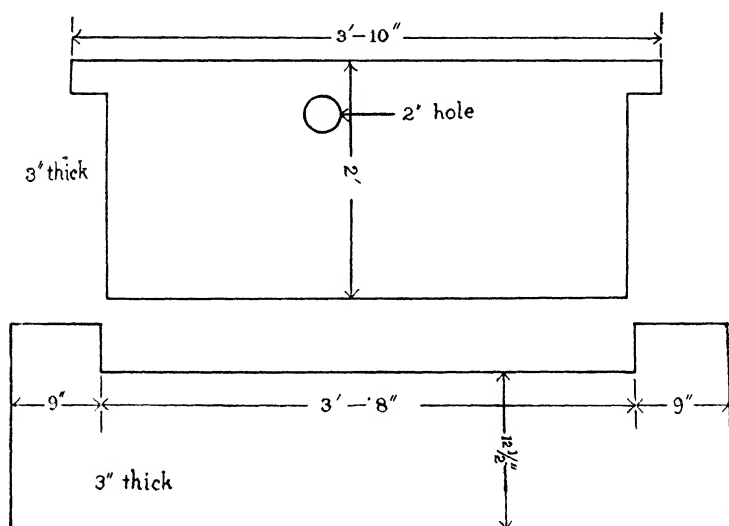


FIG. 4. Stone Door (?), Roamgarh.

joined to Sideswar by a thin ewe neck, while covering the top and extending along the neck to where it commences to dip is the remnant of a thick bed of laterite which presents a vertical face of about 15 ft. to the slope on the west and what look like two or three 6-8 ft. terraces roughly cut out of the laterite to the north and east. The laterite bed extending along the neck has the appearance of a causeway, but comes to an abrupt end in a face about 15 ft. high, at which point the width has narrowed down to about 8 ft. The strength of the position from a defensive point of view, except where a supply of water is concerned, is very evident and the view commanded therefrom embraces all the flat country to the east, north and west

and the spurs around Sideswar to the south. On the highest part are the ruins of a circular brick-built watch-tower of which only some 5 ft. now remain, the rest of the brick walls lying scattered around and down the south-eastern slope of the hill. The bricks seem to be of two sizes lightly burned and mixed with rice straw, the smaller $10\frac{1}{2} \times 6 \times 3$ ins. and the larger about $20 \times 10\frac{1}{2} \times 3$ ins., but the length of the latter is uncertain as so far only broken fragments of these up to 15 ins. in length have been recovered. The circular tower, which is now filled with debris in the centre, is set on a brick plinth built on the laterite and covered by spear grass for the greater part of the year. The place is now the haunt of hyenas which have small passages through the laterite leading towards the tower and from the weathered material lying on the floor of these they probably at one time afforded access to chambers cut out of the laterite bed. Some years ago an attempt was made to clean the debris out of the watch-tower until a small hole put through was tested with a long drill and as this failed to find any bottom and liberated swarms of fleas, work was stopped. In 1926, the place was re-visited after a couple of years' absence, when two human skulls¹ were found lying on the flat ground near the northern entrance that had not been there previously. As the writer had been asked to collect skulls by W. P. Pycraft, these were submitted to him for measurement with the following results:

		Cephalic Index	Nasal Index	Alveolar Index
No. 1 ..	..	73.4	48.0	101
No. 2 ..	..	72.3	57.4	102

Near the foot of the plinth on the south side was a flat piece of schistose quartzite sticking out of the ground, 5 ft. 2 ins. long, 14 ins. wide and 3 ins. thick with the central portion of one side cut away to a depth of $1\frac{1}{2}$ ins., while close to it a piece of similar stone 2 ft. wide lay nearly covered by earth and broken bricks. On extraction it was found that the shorter side of this fitted the recessed portion of the other stone while the opposite side had a 1 in. pivot at either end and a circular hole 2 ins. in diameter about midway near the edge. Higher up on the flat ground below Sideswar is a slab of similar rock 10 ft. long by 2 ft. wide by 3 ins. thick, presumably intended for Roamgarh, but abandoned on the way and close to it, the writer picked up a broken stone pestle and various crushing stones though here they are far from plentiful, as further west. Recently on cleaning out one of the ancient copper workings near Roamgarh thousands of pieces of pottery were uncovered

¹ These two skulls have been re-examined by Dr. B. S. Guha in 1935 through the courtesy of the Keeper of the Natural History Museum, South Kensington, London, and a short note will be published in near future.—*Editor*.

in the refuse surrounding the shaft. The higher layers contained only red clay pottery similar to that used in modern times, but

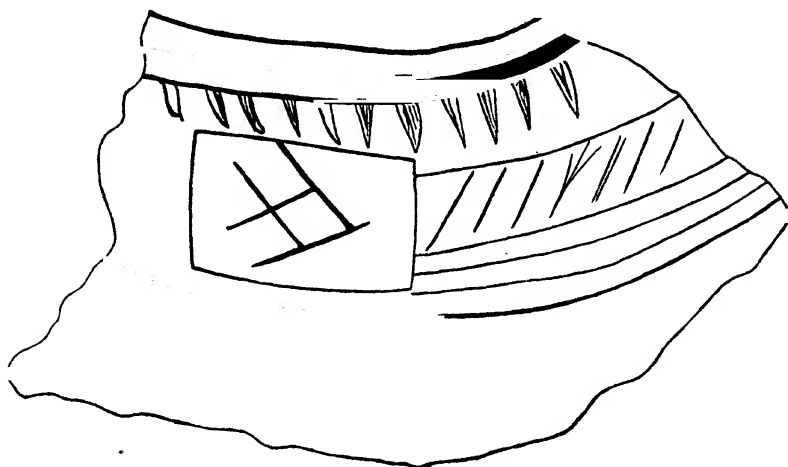


FIG. 5. Pottery, Roamgarh.

as the cut got deeper, this gave place to yellow and often to dark and nearly black pieces of superior manufacture and finally to the elaborately ornamented fragment illustrated. In the same locality was found the broken portion with moustache and eyes, the nose forming a spout used perhaps for pouring

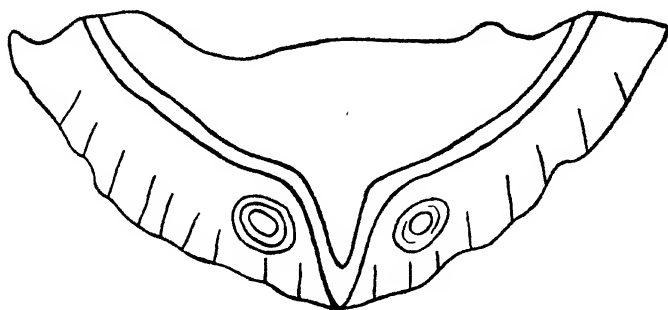


FIG. 6. Pottery, Roamgarh.

oil into the miners' lamps previously discovered in the vicinity. The eyes were black and shiny like slag and firmly fixed in the baked clay. The superior workmanship of the earlier workers was thus again clearly established.

Shrines.

South of Asanboni, near the bank of the Garrha Nallah, and north of Badia beyond Mosaboni in the central portion of the pergunnah, are the remains of two similar shrines. When the writer first knew them many years ago both were deserted, but on subsequent visits to them the former was found to be occupied by a Hindu priest who had collected and replaced some of the scattered fragments. The walls, which had been roughly rebuilt to a height of 2-3 ft., were made of laterite blocks tongued and grooved in many cases to fit one another in one of two ways. The former was to leave a triangular tongue with one inclined and three vertical faces midway near one end that fitted a corresponding groove in another block while the other was to double mortise the centre of a block and have a tenoned piece to accord. Another piece of laterite in the shape

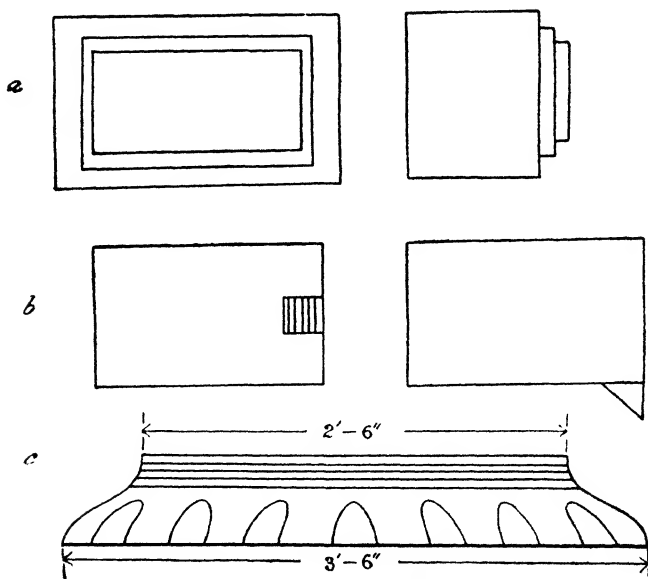


FIG. 7. Wayside Shrines. *a* and *b* Laterite building blocks.
c Pedestal.

of a circular pedestal bore rough carving being stepped near the top and bottom and curved in between. Among the relics dug up by the priest was a slab of hornblende schist about $3\frac{1}{2}$ ft. long, 1 ft. wide and 3 ins. thick that bore figures in twelve panels and ornamentation on either side of them. At the head was a wheel followed in the second panel by a kneeling human figure, a deer, an animal like a rhinoceros, a sitting

human figure, then a standing one, an elephant, a squatting human figure followed by one bending, two human figures, a female figure bending, and a female bust; after which the ornamentation ended in a large standing male figure whose legs and arms were in positions similar to Egyptian carvings, which occupied most of the end of the stone. Unfortunately during subsequent building operations this stone has disappeared. In addition to this were two phalli of similar rock

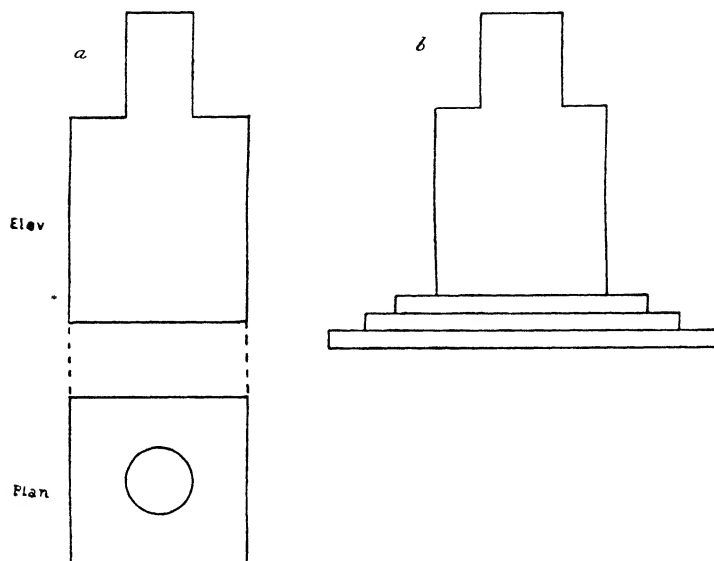


FIG. 8. Wayside Shrines, Asanboni.

and a square soapstone yogi with three projecting bands round the top, centre and bottom and a panel in the centre of two sides which bore a sitting figure, while the top, which was

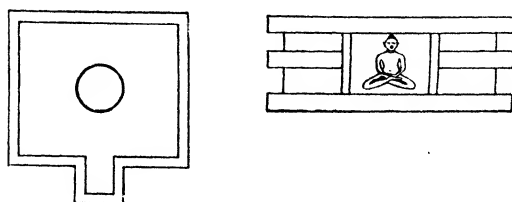


FIG. 9. Yogi.

recessed, had a spout and a circular boss in the centre level with the sides.

This shrine is in such disorder that it is necessary to refer to the one at Badia for a realization of how it formerly must have been. About a mile west of the village of Gohala and not far from the south bank of the Subarnarekha is a cluster of trees some of which seem to be growing from an elevation higher than the alluvial plateau that surrounds them and in the midst of them are the remains of a shrine with walls still standing to a height of 9-10 ft. The outside measurements are roughly 15 ft. wide by 16 ft. long, with the major axis and entrance facing east, and the walls 4 ft. thick made of rectangular laterite blocks of varying sizes; leaving an open space inside 7 ft. 9 ins. long by 7 ft. wide which was once paved with flat soapstone slabs, one of which bore carving in the centre that resembled a four-petalled flower. Two of the inside blocks of laterite, one on the south side of the $2\frac{1}{2}$ ft. wide entrance and the other near the western end of the south wall have niches cut in them with lean to tops and straight sides and bottoms, which measure about 5 ins. by 5 ins. at the points of greatest dimension and are sunk 3 ins. into the stone. Outside close at hand is a circular pedestal of laterite about 3 ft. in diameter and 8 ins. thick stepped and carved in a similar manner to the one at Asanboni. Further away again and beside the path to Gohala is a rectangular carved soapstone pillar, with rounded

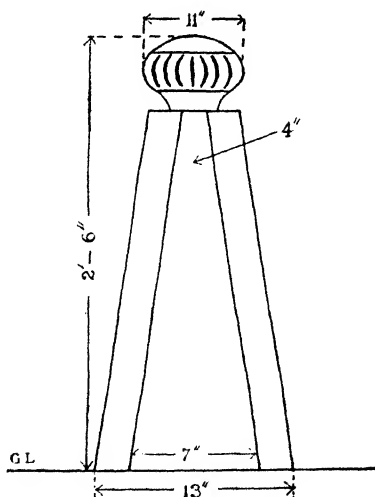


FIG. 10. Gohala Shrine—Soapstone Pillar.

head and neck, which projects about $2\frac{1}{2}$ ft. above the ground. The rounded head is ornamented by a ring near the top and vertical rolls while the rectangular portion which has 11 ins. sides at the top, increasing to 13 ins. at the bottom, has smoothed bands along each side $3\frac{1}{2}$ ins. wide at the top and diminishing to 3 ins. towards the base so as to leave a roughly dressed panel in the centre. Beyond Kuyali on the road to Kundrukocha are the remains of a similar shrine, where the aborigines now offer sacrifices. The usual laterite pedestal and blocks of the same stone lie about or are enclosed in a mud hut covered

by a roof of thatch. Remains of a fourth shrine also occur near the south bank of the Subarnarekha River in Mayurbhanj State near Baragora where a phallus has a metal 'nāg' coiled

around it. The usual laterite blocks and four pedestals, differing in size, lie around. Gravely mentions the existence of several similar shrines in Ganjam and the northern Telegu country.¹

The ancient gold workers have left many traces of their industry in the southern part of the pergannah, and on the way from Kasibera to Kundrukocha is a large flat grinding stone with a few other slabs of rock which cover clay pots containing broken bones and must have been brought there by a succeeding generation that marked this burial ground by three upright monoliths. The largest collection of grindstones is found in the jungle along the western side of the nallah that comes down from Porojarna and Kerriam where several hundred stones must have been in use; while the next largest of about 100 stones is east of the two Putra shafts, being separated from them by a ridge and nallah which descend from the hills forming the Mayurbhanj boundary. Another lot of about 50 occurs further east where the Rangra spur joins the boundary range and nearly all of the three lots of stones seem to have originated from a band of fine-grained trap that runs up the nallah past the back of Porojarna Hill until it is lost near Putra South shaft in the main range. Why the ancients should have gone to the trouble of carrying heavy stones for about a quarter of a mile over rough country and away from water to the Rangra spur is not evident unless old workings still remain to be discovered in this vicinity. The only other large accumulation of stones occurs to the east of Mangru; and though rock and water are handy here this seems to have even less cause for its existence as no old workings have been found within a mile of the collection. In the circumstances the writer has come to the conclusion that the gold workers, coming from the north, fixed this, being in an open position and comparatively healthy, as their base from which to test the surrounding country, which in those days must have been covered by dense jungle and have had more than sufficient tigers, leopards and bears to add interest to a miner's life. As malaria is also unusually prevalent in these parts in the hills and elephants are not uncommon, the lot of the early workers cannot have been all that could be desired. The grinding stones are almost always made of trap, though occasional ones of quartzite or hornstone are met with, from 2-3 ft. long, 12-16 ins. wide and 4-9 ins. thick. A few that have been wide enough to take two grooves with a dividing ridge on each side are known, as well as one nearly rectangular stone about 3 ft. long by 1 ft. wide and deep that had a groove along each of the four sides and took four coolies to carry, but the regular weight is from 30-60 lbs. Generally both sides were used and grooves worn lengthwise by the forward and

¹ An Outline of Indian Temple Architecture, F. H. Gravely.

backward movement of a stone muller held in one hand on material that had received a preliminary crushing, sometimes from the back of the muller stone or more often from a stone specially for this purpose. As no anvil stones are found, the same block must have been used for both purposes, the process being continued until the stone cracked with the hammering or a hole was worn through the centre of the grooves. Near the upper end of the largest lot of stones, below Porojarna where the trap widens, a large block on the outcrop has been used for grinding *in situ*, but this is unique in this locality.

The main old workings are found at Porojarna, Kerriam, Rangra and Suraigora while others exist on Jhik, Chailom, Gande and Bin Dungris (dungri = hill), and metal tools would seem to have been mainly used for mining as only three or four doubtful hornstone chisels and one doubtful trap hammerstone have been found, apart from those in the bottom of the Porojarna workings. Had copper been used, some of these implements would probably have survived the passage of time, whereas iron must have been lost by oxidation, so the main work here must have been done during the iron age and probably later than the commencement of that on the copper belt. The finding of stone beads and a ringstone similar to those at Bonidi show that this art was known to the early workers, but if copper slag formed the base of the glass beads, as seems probable and the stone ones were made in the locality, it is not surprising that they are not to be found here as the nearest copper slag is about 20 miles distant.

A place, that might lead to further relics, occurs near Sapgora, over the border in Mayurbhanj, where an ancient shaft has a circular stairway leading down to stopes. The bottom of the shaft was filled with debris and countless pieces of earthenware pots, presumably broken while dealing with the water in the stopes. Unfortunately only some of the debris had been cleared in 1917 before orders were received to stop all work and nothing further has been done, though desirable from both mining and archaeological interests.

Summarizing the evidence at present available regarding the ancient workers we have the following:

1. Coins of the third to fifth centuries A.D. near Roamgarh;
2. Tradition and history;
3. Roamgarh and remains of shrines;
4. Burial urns and other pottery;
5. Beads;
6. Palaeolithic and Neolithic tools.

The only definite date that can be fixed from the above at present is that of the Kushan type coins, found in a clay burial

urn with fragments of bones at Rakha Mines, so that the workings must date at least from this period. From the projections left on the sides of the coins these were probably unused and must have been cast in rows in a mould. Similar coins have been discovered south of Chaibassa and in various parts of the districts of Ganjam, Puri and Balasore as well as in the State of Mayurbhanj. If we examine Indian history at the times indicated by the coins, we find that the Kushan empire started to break up with the death of Vasudeva around 220 A.D. and any influence that they had over Eastern India had disappeared by the middle of the third century. Chandragupta, the founder of the succeeding Gupta empire in the fourth century, married a princess of the Lichhavi clan who had Thibetan connections so that either he, or his son Samudragupta, could easily have obtained technical assistance from the Chinese had they required it in the working of the copper mines. In any case, there was considerable trade between India and China over centuries through the port of Tamluk.

Coming next to the legend of the Jains this is as indefinite as the Chinese connection, the religion dating from the sixth century B.C. and continuing down to the tenth century A.D., or 300 years after the time of Harsha, who was visited by Hiuen Tsiang and sent and received missions to and from China. Again, Chota Nagpur formed part of the empire of Asoka, who as a true Buddhist honoured all sects, so that there is no reason why the lay Jains should not have worked the mines during his reign and added to the riches of his empire. On examining the records left by Megasthenes of his sojourn at the court of Chandragupta Maurya, the grandfather of Asoka, more light is thrown on the state of India in those times. The capital of Magadha, the ancient city of Pataliputra, was about 9 miles in length by $1\frac{1}{2}$ miles in breadth, defended by a moat fed by the river Son and timber pallisade that had 570 towers and 64 gates; gold, silver, copper, pearls and precious stones were abundant, some of the gold basins being as much as 6 ft. in diameter while many vessels, definitely stated to have been made of Indian copper, were set with precious stones. During his reign woodcutters, carpenters, blacksmiths and miners were subject to special supervision, while punishment for Brahmans who offended included, being sent to the mines for life. As men, it seems, could not be wholly relied upon, the king had an Amazonian bodyguard obtained by purchase from foreign countries. Jain tradition affirms that he was of their faith and that following a twelve years' famine he abdicated, becoming a Yogi or ascetic. The nearest copper mines of any size to the capital are those of Baragunda in the Hazaribagh district and Singhbhum, so that it seems probable that they furnished at least some of the copper of the vessels used at the court.

Some of the Śāisunāga dynasty, which preceded that of the Mauryas, are also considered to have been Jain and both the Mahāvamsa and Hiuen Tsiang refer to the last of this line as being the possessor of great wealth and being so hated that he was finally deposed. Stoehr and Durr Schmidt have left records of a tank below Roamgarh being attributed to the Jains and the fort of Roamgarh having been built by a Raja who spoke two tongues (do jib). Dalton, however, considers this to mean that he belonged to a serpent (Nāg or Nāga) race, meaning the Kols and it may not merely be a coincidence that the Nandas were of Śūdra origin, having usurped the throne from the former higher caste rulers.

The only other earlier historical reference throws no light on the copper workings, but records that under Darius the Asiatic satrapy used to pay as annual tribute of 360 Euboic talents of gold dust to the Persian empire, or the equivalent of about a million sterling on a normal pre-inflation basis. If burial urns similar to those occurring in Singhbhum could be found in other parts of India and some definite date be assigned to them, a further link in the chain could be forged, but at present this link remains incomplete, as the urns discovered by Laffitte¹ near Pondicherry bear no similarity either in size or markings to those of Dhalbhum. A question that remains unanswered is—why should each urn in the Goradi burial ground have a distinctive neck marking; was a record thus kept of those whose bones each contained and, if so, with what purpose?

A comparison of the beads from Bonidi with those from other places shows that many of the types are almost identical with those recently unearthed at Ur and those from Khorsabad that were in the Louvre. The most striking instances of similarity to Ur are the flattened barrel-shaped stone beads with lined ends, and the terracotta sections, the second shape being also found in Egyptian beads and the first at Mohenjo Daro. The table on p. 103 gives some of the beads found at Bonidi and compared with those in the British Museum, the Louvre and a few from Mohenjo Daro with the dates assigned to those from Ur. Unfortunately few of the beads from Mohenjo Daro have been accessible to the writer in Calcutta or that column would doubtless have more entries, while the Āzamgarh beads are confined to the exhibit in the British Museum. If any connection can be placed on the Ur dates for similar beads at Bonidi, the working of copper in this locality would be carried a large step backward and the connection of stone implements with the manufacture of the beads and the working of the copper would confirm their antiquity.

¹ *Loc. cit.*

	Bon.	Khor.	Phoen.	Sumer.	Ur	M.D.	Azam.	Ur. date B.C.
Blunt end double hexagon ..	S	S	..	S	S	..	..	..
Blunt end round ..	S & DG	S	..	..	S	..	TC	2000
Round ..	S	S	S	..	..	..	S	..
Round with central ridge ..	S	S	S	S	S	..	..	1400
Flattened barrel plain ends ..	S	S	S	S	..	..	S	..
Do. lined ..	S & DG	..	..	..	S	S	..	2000
Cylindrical ..	S & DG	S	..	..	S	..	S	2000
Sections ..	S & TC	S	..	S	TC	..	..	600
Barrel-shaped ..	S	S	S	S	..	..	S	..
Rough, round or flattened ..	S	..	..	..	S	..	..	1900
Fang shape ..	S	..	S	..	..	..	S	..

S = Stone, DG = Devitrified glass, TC = Terracotta.

The dates assigned to the Sumerian beads in the Louvre are from 3000 to 2500 B.C. As glass beads seem to be mainly confined to Bonidi no comparison of these has been possible and bead types unique to Bonidi have been omitted.

It may be argued that the civilization of the present inhabitants of the district is so little removed from that of the stone age that relics of this betoken no great antiquity, but against this may be set the facts that we have one fairly definite date, that all accounts of the working have been lost and that they are to-day quite incapable of doing what has been done in the past. A comparison of the present-day crude open-cast soapstone plate workings with the ordered circular shafts and stopes of the ancients show how much the earlier civilization was in advance of the present, while the smelting of copper and manufacture of beads are not likely to have been entirely lost had they originated, or been common practice, among the tribes of the district in comparatively recent times. The ancient civilizations that existed at Ur, Harappa and Mohenjo Daro seem to have many features in common that can only have originated through intercourse and time may prove that these influences extended further eastwards than has been thought.

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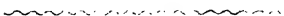
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FIG. 1. Gold Crushing Stones, Kundrukocha.



FIG. 2. Gold Crushing Stones, Bhitari Dadi.



FIG. 3. Ancient Copper Working, Baragora.



FIG. 2. Soapstone Outcrop, Bhitar Dadi (South).



FIG. 1. Ancient Soapstone Workings, Bhitar Dadi (North).



FIG. 3. Remains of Stone Mining Tools, Talsa.



FIG. 4. Cores and Flakes of Quartz and Hornstone, Banabassa.

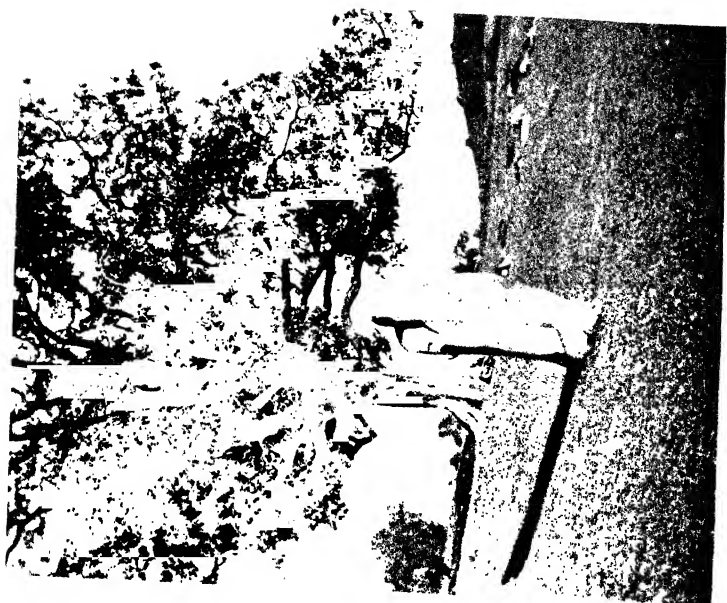
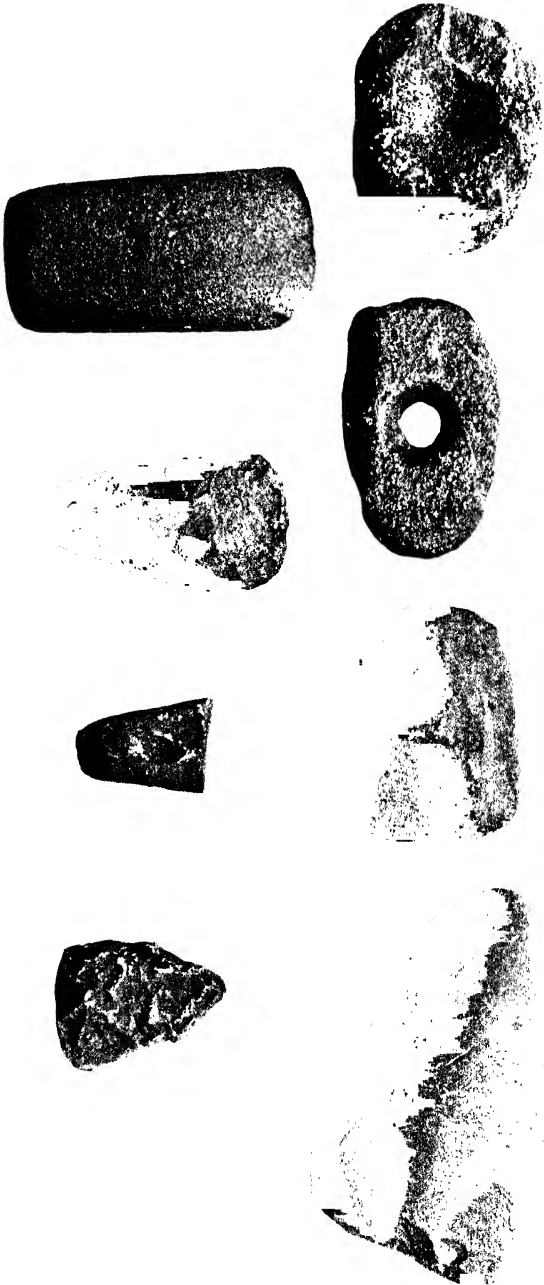


FIG. 2. 'The Widow', near Kalikapur.



FIG. 1. Shrine and Pillar near Gohala.



Stone Implements from India, Talsar.

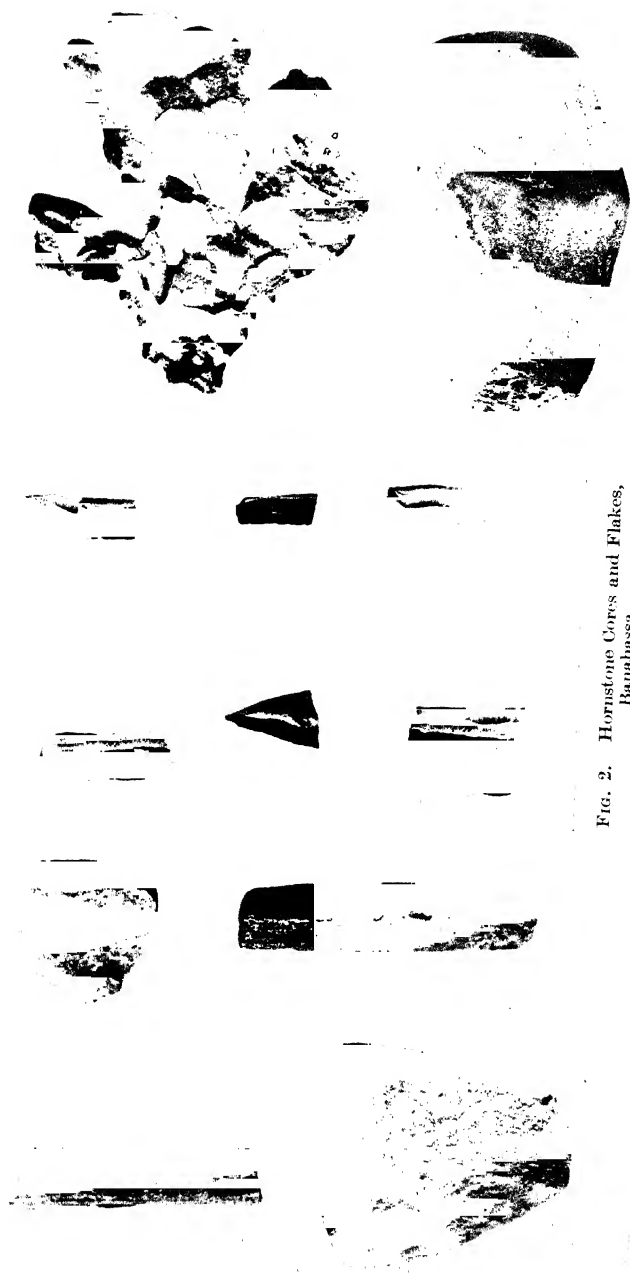


FIG. 2. Hornstone Cores and Flakes,
Banabassa.

FIG. 3. (1) Bead Slag, Bonidi.
(2) Broken Pestle, Rakha.

Fig. (1) Stone Axe head.
(2) Cylindrical Slag and Core, Goradi.

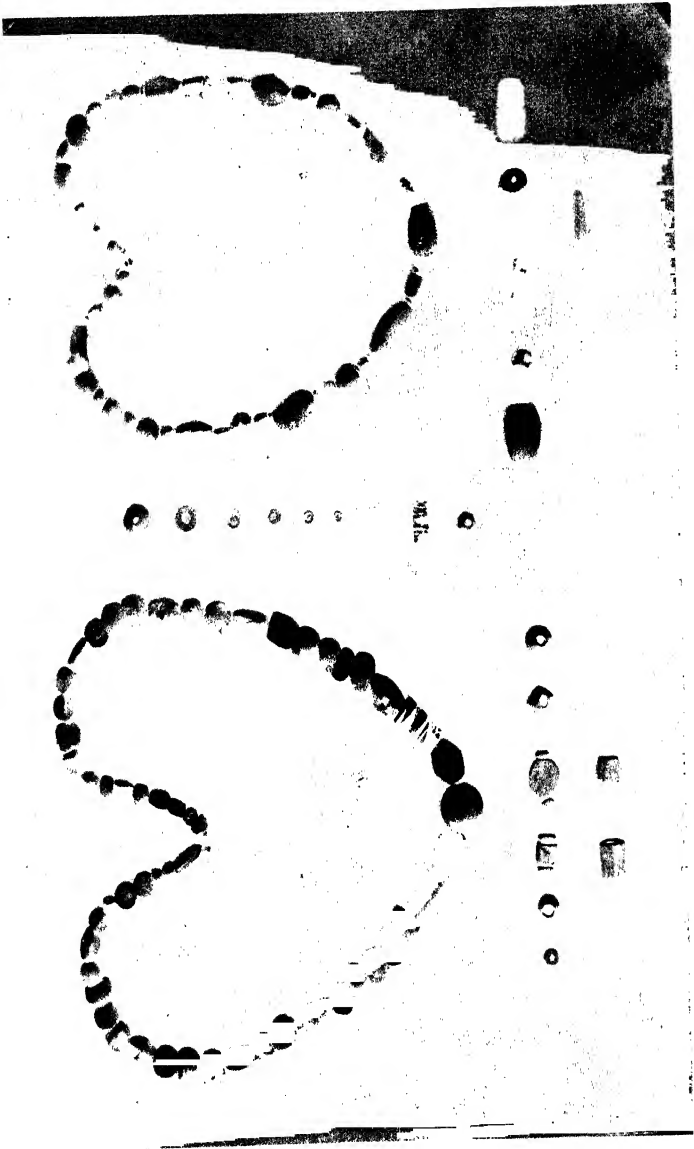


Photo of Beads.

Panegyric of Malaivamma.¹

By CHINTAHARAN CHAKRAVARTI.

The panegyric which consists of eighty-four verses is a rather unique one. The verses form part of a Tantric work² which deals with *Yantras* or symbolic diagrams. The description in it of each *Yantra* is concluded by a verse describing the author's patron or one of his ancestors, children or relatives referred to as having obtained success through the worship of the *Yantra* under description. It is gathered from these verses that Malaivamma, the patron of the panegyrist, who ruled over the hilly country called Rukma, situated on or near the mountain called Tākama, was the son of Ghanaśyāmamalla and Pārvatī (daughter of Virabhadra) and grandson of Sāhamalla. It is stated that he married Mahalavasantā, daughter of Dalasāhi and Śubhadrā, whose dominions lay on the hill called Khāñcī. As many as seven sons were born to the king each of whom has a verse devoted to him. The magnanimity of the king, especially with reference to the author, is extolled and it is definitely asserted that he gave to Premanidhi, the author of the work mentioned above, considerable property and a house in Benares. It is further stated that he consecrated a temple to god Śiva at the confluence of the Maṅgalā and the Gaṇḍakī. He also secured the release of the king of Mustān who was made prisoner in Kākavenī by Jumaliśvara. Incidentally the panegyric gives a detailed genealogical account of Malaivamma going as far back as his eleventh ancestor and as far down as his grandsons.

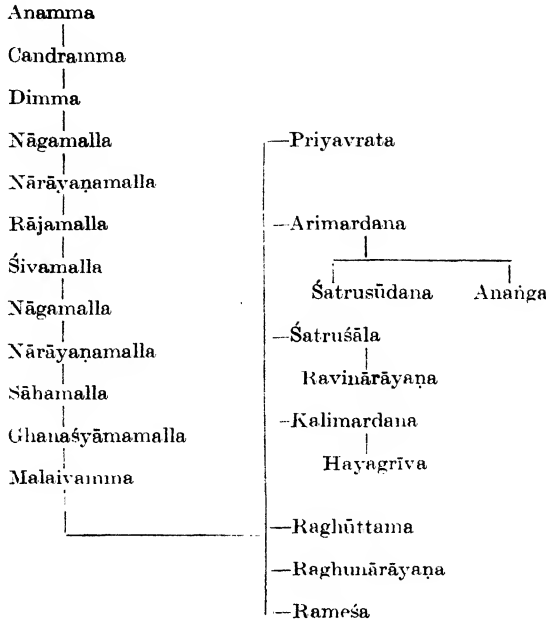
¹ Malaivamma was the king of a principality in Nepal which was later on conquered by the Gorkhas. The country ruled by him was included in the Chaubisi states of the Sapt Gandaki Pradesh of the present kingdom of Nepal. A short but imperfect history of the rulers of this place is given by Hamilton (*Account of the Kingdom of Nepal*, etc., Edinburgh, 1819, pp. 269-72).

I am indebted for this information to Mr. Suryavikrama Gewali, author of *The Life of Prithvinarayan Shah*, published by the Nepal Sahitya Sammelan.

² This is a commentary on the *Yantra* section of the *Śivatāṇḍava* (Chapters XII-XIV). The RASB possesses two MSS. of the work—one complete and the other incomplete.

One MS. of the work was described by Prof. Peterson (*Cat. Sans. MSS. Ulwar* No. 2389), but he made no reference to these verses. Pandit Narayana Shastri Khiste also has taken no notice of them in his article on *The Life and Works of Premanidhi* (*Nāgarīpracārīnī Patrikā*, Vol. VI, 1982 V.S., pp. 371-379).

The genealogical table may be constructed thus on the authority of these verses:—



The author of this panegyric was Premanidhi Pantha who hailed from Kūrmācala or Kumaon. It is learnt from the concluding verses of his works that he was the son of Umāpati and Udyotamati and was a worshipper of Kārtavīrya. Little is known about his life and family. We are told that he had sorrowful bereavements in his family. He lost his beloved wife at a comparatively young age. It seems he thereupon left his ancestral home and came to be settled in Benares where on the completion of his commentary on the *Śivatāṇḍava*, he was given considerable property and a house by his patron and disciple Malaivammadeva. Reference is made to two daughters of his—Mahālakṣmī and Kanakā. This much of his personal history may be gathered from his commentary on the *Śivatāṇḍava*¹ in which he incidentally describes his patron and makes reference to himself.

¹ अस्यादिप्रचुरं हिमांशुवचिरं सौभाग्ययुक्तं गृहं
 पूर्वं संहरतो यमस्य शतशो दुष्कीर्तिरेव स्थिरा ।
 स्वर्णादिप्रचुरं सुभांशुवचिरं सौभाग्यपूर्णं गृहं
 यत्कथं हि मया पुनर्नवतमं श्रीमन्मलैवमृतः ॥ १ ॥
 मयेत्यस्मादा ज्येष्ठभार्यावियुक्तः प्रकृतग्रन्थकर्ता विवक्षितः ।

It appears from the introductory verses of the *Sudaraśanā*¹ (commentary on the *Tantrarājatantra*) that he had a third wife, Prāṇamañjari by name, who composed the commentary in memory of her son called Sudarśana. The name of the father and the mother of this wife are given as Harṣadeva and Harṣamati.

The time when he flourished is roughly indicated by the references to dates of composition given in some of his works. We are told that he composed the *Mallādarśa* and the *Dīpa-prakāśa* in 1648 Ś.E., *Prṥhvipremodaya* and the commentary on the *Śāradaṭilaka* in 1659 Ś.E., the *Jagatpremodaya* in 1663 Ś.E., the *Prāyaścittupradīpa* in 1675 Ś.E. This would point to the second quarter of the eighteenth century together with a portion of the third as the period of his literary activities.

Premanidhi was the author of a good many works on Tantra and Smṛti. He himself refers to some of them. He mentions six works of him at the end of his commentary on the *Śāradaṭilaka*, and three at the end of the *Śabdaprakāśa*, while the *Mallādarśa* incidentally refers to the *Bhaktitarāṅgiṇī*. In the descriptive catalogue and the lists of his works based on them as given by Aufrecht and Kane different portions of the same work appear to have in some cases been indicated as separate

किञ्च, रे रे पाप कृतान्त मांसमयमङ्गेडापहारात्त्वया

भुक्तिर्मेऽपहृता कृता बत महालक्ष्मीश्च निर्मातका ।

काश्यामेव मया दृढमथगृहे प्राप्ते मल्लैवस्मृतौ

विन्यस्तापरमातृके किल महालक्ष्मीवरो वासितः ॥ २ ॥

महालक्ष्मीश्च ग्रन्थकर्तुः कन्योक्ता । अपि च,

पिशितमथगृहं किं स्यतुना भुक्तिबीजं

हृतममलमकस्मादस्मदेकाग्रितस्य ।

इति मल्लवसन्नायुग्ं मल्लैवस्मदेवो

दृढकनकसुक्तायुक्तगृहं दर्शितः ॥ ३ ॥

ग्रन्थकर्तुर्द्वितीया कन्या यदि कनकापदेन विवक्षिता तदा दृढा कनका
यत्रेत्यर्थोऽपि सम्भवति । अन्यच्च,

किं सूर्य्यसूनो तव धर्मराजता बलाद्गृहीता मदुपाययेण हि ।

श्रीमन्मल्लैवस्मद्वेषेण केवलं कृतान्तताशेष ततः प्रकुप्यसि ॥ ४ ॥

Fol. 37B of the MS. described under ASB. VIII, 6817. Also cf. the last verse of the panegyric.

¹ *Nāgarīpracārīṇī Patrikā*, N.S., Vol. VI (1982 V.S., p. 376, f.n.). The commentary is also attributed to Premanidhi (Cat. Cat. I. 222, II. 46). A portion of the commentary is preserved in a fragmentary manuscript described in ASB. VIII. 6819. An edition of its first chapter on the basis of one imperfect manuscript belonging to the Sanskrit College of Calcutta has been published by Dr. J. B. Chaudhuri (Calcutta, 1940).

works. The same work has also sometimes been referred to under different titles. A brief account of the works on which more or less definite information is available is given below:—

1. *Prayogaratnākara* deals with the rites in connection with the worship of Kārtavīrya. No complete MS. of the work is known. Portions of the work found scattered in different parts of the country made it difficult to form an idea of the exact nature of the work. Eggeling in his India Office Catalogue (I.O. IV. 2595) frankly acknowledges this difficulty. A MS. of the concluding portion of the work belonging to the old collection of the Royal Asiatic Society of Bengal contains a detailed list of contents and thus indicates its extent and reveals its identity. It is gathered therefrom that the work is complete in three parts, each divided into several chapters. The Government Collection of Sanskrit Manuscripts in the RASB contains a MS. of the first three chapters of the second part of the work while MSS. containing the first nine chapters of the first part and the last three of the third part are found respectively in the India Office (I.O. IV. 2595) and the old collection of the Society (No. I.E. 54). Several other chapters, not identified heretofore, are also found scattered in different places. Thus the old collection of the Society contains MSS. of the last chapters of Book II as also first and second chapters of Book III (Nos. I.E. 52 and III. D. 65). A MS. of the first chapter of the last Book has already been described in ASB. III. 2412 and Nep., II., p. 141.

2. *Prthvīpremodaya*¹ (composed in 1659 Ś.E.). The last section of the work appears to deal with *Prāyaścitta*. A fragment of a work on *dāna* found along with the Society's incomplete MS. of the *Mallādārśa* may not unlikely belong to this work one section of which deals with *dāna*.

3. *Jagatpremodaya* (ASB. III. p. 189). The work was composed in 1663 Ś.E. This, at least a part of it, deals with *Prāyaścitta*.

4. *Prāyaścittapradīpa* (composed in 1675 Ś.E.)². A work of the same name composed in 1654 Ś.E. is also attributed to the patrons of Premanidhi—Malaivamma and his wife. A MS. of this work is reported to exist in the library of Rajguru Hemraj of Nepal³.

5. *Dīpaprakāśa* (ASB. VIII. 6511). The work deals with the rite of dedicating lamps to Kārtavīrya. The topic also covers the first chapter of the last Book of the *Prayogaratnākara*.

¹ I am indebted to Mr. P. K. Gode, Curator of the Bhandarkar Oriental Research Institute, for kindly supplying me with a description of the fragmentary MS. of the work belonging to the Institute.

² Kane, *History of Dharmasāstra* (p. 713). The concluding verses of the Commentary on the *Śāradātīlaka* refers to the work.

³ I am indebted for this information to Mr. Suryavikram Gewali of Darjeeling.

TEXT OF THE PANEGRIC.

- Fol. 24A, विविधतरनराणां पालने भूरिद्धा[भा]रो
हरिचरणसमर्चाचेतसो नैककस्य ।
भवति सङ्गनयोग्यो ह्येतिकान्ताद्वितीयः
समवति नरलोकं श्रीमल्लैवमभूपः ॥ १ ॥
- 26A, मङ्गलपदमुपात्तं भाषया गेह्वराजं
सततमिह वसन्तस्तत्कृपातोऽथवैषा ।
स्युततद्वपतिदत्ते तत्र वाञ्छावसन्त-
स्त्वितिमङ्गलवसन्ता नाम राज्ञ्याः कृतार्थम् ॥ २ ॥
- 26B, अस्तुत्तरस्यां दिशि रक्तानामको
देशस्तस्माकमसंज्ञपर्वते ।
आनमभूपालवपुःसमाश्रितो
गत्वा प्रजाः पालयति स्म केशवः ॥ ३ ॥
- 27B, चन्द्रमनामष्टपतिर्द्विजध्वन्विद्यात्
तत्तद्विनोदविनिवेदितभूरिवित्तः ।
आनमभूपतनयः सकलाः प्रजा यः
खानन्दिताः किल चकार नकारमृदः ॥ ४ ॥
- 28A, चन्द्रमभूपदूदभूदपूर्वी
राजाधिराजः किल दिग्मनामा ।
यस्मिन् महर्षौ शासति नाकवाञ्छा-
दरिद्रताभूदखिलेऽपि लोके ॥ ५ ॥
- 28B, श्रीदिग्मभूपालसुतस्त्वपूर्वी गुणैरभूदभूपतिनागमङ्गः ।
नागः प्रजा अस्य कदापि चक्रुः सुनौतिकेतुस्तदयं तु नागः ॥ ६ ॥
- 29A, श्रीनागमङ्गादुपमादरिद्रो
बभूव नारायणमङ्गभूपः ।
यस्मिन् क्षितौ तिष्ठति देवल्लोको
लक्ष्म्या विह्विनोऽभवदाश्रयः ॥ ७ ॥
- 29B, बभूव नारायणमङ्गभूपतः श्रीराजमङ्गः क्षितिपालकायशौः ।
प्रजात्रजारक्षन्कर्मतो भृशं राजेतिनामार्थयुतं चकार यः ॥ ८ ॥
- 30A, श्रीराजमङ्गतनयो विनयाम्बुराशिः
सम्मानिताखिलधरासुरकावतंसः ।
स्त्रीयप्रतापपरितापितवैरिसार्थ
आसीदसीमगुणकः शिवमङ्गभूपः ॥ ९ ॥

- Fol. 30B, नरपतिशिवमङ्गादुद्गतो नागमङ्गः
 क्षितिपतिवरमौलिप्रस्फुरद्रुतभूतः ।
 निजगुणगणवयैरद्वितीयो द्वितीयः
 सकलवृत्तिरगोष्ठीस्वागतः स्वप्रसङ्गः ॥ १० ॥
- 31A, बभूव नारायणमङ्गभूपो द्वितीय उर्वीपतिवन्द्यपादः ।
 यो नागमङ्गस्य पितुर्वियोगं विस्मरयामासतरां प्रजानाम् ॥ ११ ॥
- 31B, अस्मिन् नृपालरत्नाकरे तु वंशार्णवे तस्मात् ।
 विद्वज्ज्योतिर्यो जातः श्रीसाहमङ्गन्दुः ॥ १२ ॥
- 32A, घनश्याममङ्गो घनश्याममङ्गो
 नृपः कोऽप्यभूत् साहमङ्गवि[क्षि]तीन्द्रात् ।
 यदीयप्रजानां विषादः शिवाग्रो
 परो नीतिसङ्गादनीतिश्च सङ्गात् ॥ १३ ॥
- 32B, घनश्याममङ्गक्षितीन्द्रस्य पुत्रो
 नृपः श्रीमलैवम्भनामा सुरद्रुः ।
 हरिर्वा रविर्वा त्रिभुवा स्मरो वे-
 त्यलं सर्वधर्मः सतां संशयक्ष्मा ॥ १४ ॥
- 33A, हरिमदनशशाङ्कस्वद्रुभान्वादिशङ्का-
 परिहृतिकरणाय श्रीमलैवम्भपत्न्यौ ।
 इह महलवसन्ता नाम कृत्वेन्द्रिरैव
 प्रणिभवति धरायामर्थिसार्थार्थहेतुः ॥ १५ ॥
- 33B, श्रीमन्मलैवम्भनृपालसूनुवः
 सङ्कोदराः सप्त सतासिरायुषः ।
 प्रियव्रतस्तेषु कुमार आदिमः
 कुमारमारादिविजिदुरः ॥ १६ ॥
- 34A, पुत्रोऽसावरिमर्दनो नरपतेरास्तेऽद्वितीयो गुणै-
 राद्यः सद्युविनयादिना निजवशीभूतोभवद्विचक्रः ।
 योऽरीणां बलतः प्रतापदहनज्वाल्लोपशान्यादितः
 सत्प्रज्ञैररिमर्दनेत्यभिधया संयोजितः सार्थकः ॥ १७ ॥
- 34B, गुणैर्युतस्यापि गुणैर्मितश्च श्रीमलैवम्भनृपालज्जातः ।
 अर्थेन नाम्ना च स शत्रुशालः शल्यार्थकं शालमिदं त्विच्छास्ते ॥ १८ ॥
- 35A, कलिमर्दननामास्ते तूर्यः श्रीराजसत्पुत्रः ।
 कलियुगविभवजयायानुत्पत्त्यान्वर्थसंज्ञोयम् ॥ १९ ॥
- 36A, भवति रघूत्तनामा पुत्रः श्रीभूपवर्थस्य ।
 यः संख्यापि कान्था धनो कन्दर्पमानत्वम् ॥ २० ॥

- Fol. 38A, रघुनारायणनामा राजकुमारो जयति षष्ठः ।
आजन्मार्जितदुःखध्वान्ते रविरिव हि यन्नाम ॥ २१ ॥
- 38B, भानुचन्द्रवलिकर्णसमुद्रक्षित्यनङ्गुणवानिति किं च ।
सप्तमः क्षितिपतेस्तु कुमारः श्रीरमेश उदितश्च रमेशः ॥ २२ ॥
- 39A, श्रीमन्नुपालतनयादरिमर्दनाख्याद्
अभ्युदगतो बुध इवात्र सुभांशुदेहात् ।
यः शत्रुसूदनपदेन गतः प्रसिद्धिं
स स्यादरातिमथनेन यथार्थनामा ॥ २३ ॥
- 39B, अरिमर्दनराजेन्द्रकुमारस्यापरः सुतः ।
अनङ्गनामा सध्वङ्गशिरोमणिजराग्रणीः ॥ २४ ॥
- 40A, रविनारायणनामा पुत्रः श्रीशत्रुशालस्य ।
रविनारायणतेजा बोभूयान्नृद्धरिकरुणातः ॥ २५ ॥
- 40B, कलिमर्दननाम्नोस्ति पुत्रो नाम्ना जयग्रीवः ।
भवतु जयग्रीवरूपावशेन तल्लभ्यवस्त्वाद्यः ॥ २६ ॥
- 41A, मङ्गलागण्डकीसङ्गमे पुण्यदेशे
अथवा साधुभिर्दर्शितेनाध्वनैव ।
यः किलोमापतेर्ग्राषजं सङ्गं चक्रे
तन्मल्लैवम्मतो नित्यसीख्यास्तु पृथ्वी ॥ २७ ॥
- 41B, कस्मात् स्वर्गर्भे त्रिदशः समस्ताः
शिलास्वरूपा विहिता हिता नः ।
इतीव वध्नाति हि गण्डकीं द्राक्
श्रीमन्मल्लैवम्मतल्लोकशास्ता ॥ २८ ॥
- सकलसुखहृदा मे वल्लभेन त्रिनेत्रो
रक्षसि समुपनीतो गण्डकीनामवध्वाः ।
भवसि किमिति विभ्रं तत्र याता पुरस्ताद्
इति मङ्गलवसन्ता मङ्गलां किं वबन्ध ॥ २९ ॥
- 42A, यो लोलयैव सकलामरराजमौलि-
रत्नानि नैजघ्नतिकर्मकृते ददाति ।
तं रावणं मृदितपुष्पमिवाकरोद् यः
कारागृहे कमपि तं भज्यैव्येशम् ॥ ३० ॥
- 43A, अद्यापि दारिद्र्यपदस्त्रिरल-
सच्चिन्मयैः कर्णमुखैः कृतं किम् ।
इत्येव मत्वा भुवि कल्पवृक्षः
श्रीमन्मल्लैवम्मतनुं प्रयातः ॥ ३० ॥

- Fol. 45A, किमिति भजति शिष्टान् प्रीतितो निखुतेयं
परपुत्रनिविष्टेत्येव राज्ञी सुहृष्टा ।
किमु मङ्गलवसन्ता द्वेषार्थं तयोर्द्राग
इह भवति सुयन्त्रे साधकालीवरिष्ठा ॥ ३१ ॥
- 47A, श्रीमन्मलैवम्भन्टपालवैरिणां दुष्कीर्तिकान्ता निजसन्ततिं किमु ।
समीक्षमाना विदधात्युपासनाममुष्य जाता यदखण्डसन्ततिः ॥ ३२ ॥
- 47B, मुस्ताङ्गभूपतिवरं किल काकवेण्यां
रुद्धं खदर्पवशतो जुमलौश्वरेण ।
संमोक्षयन् करुणया खचमुबलेन
प्रत्यर्थिदृन्दमखिलं जयति स्म राजा ॥ ३३ ॥
- 49A, श्रीमन्मलैवम्भन्टपालसूरिणा
प्रायस्त्विदं यन्त्रमुपासितं पुरा ।
न चेन्मनोज्ञा पतिदेवतोत्तमा
लभ्येत कान्ता कथमिन्दिरा परा ॥ ३४ ॥
- 49B, महाराजस्य राज्ञी च साधको पूर्वजन्मनि ।
आनुकूल्यं यतोऽन्योन्यं त्रिवर्गपरिवर्धनम् ॥ ३५ ॥
- 50A, श्रीमन्मलैवम्भन्टपालवर्यः प्रायस्त्विदं साधितवान् पुरैव ।
यस्मादमुष्यारिवरौघनार्थी रणादपेतं मृगयन्ति कान्तम् ॥ ३६ ॥
- 50B, मलैवम्भभूपः प्रमत्तस्माराख्य-
द्विपं स्त्रीयससर्गतो मत्तनादम् ।
शृष्टिं सद्विवेकं समाश्रित्य यन्त्रा-
दितो दूरदूरं चकारानिवेष्टम् ॥ ३७ ॥
- 51A, साधितं नृपतिना ध्रुवमेतत्
पूर्वमेव जुमलौश्वरमुखैः ।
यत्कृतापि किल विधिना किल
कृत्या निष्कललपदवीमुपभुङ्क्ते ॥ ३८ ॥
- 51B, ताकमनामकशैलो न न्यूनो नाकतो भवति ।
राजेन्द्रः करकल्पः शची तु राज्ञी कृपाधेनुः ॥ ३९ ॥
- 52A, मलैवम्भभूपन्नजारातिचेतो
न चैकत्र देशे स्थिरं जालपीडि ।
ततो वेद्मि सत्यं पुरा जन्मनीदं
खसाध्वीकृतस्वामिकं चारुयन्त्रम् ॥ ४० ॥
- 52B, श्रीराजराजेश्वरजित्यदीपदानप्रभावाद्वायितारिपक्षः ।
अप्यन्यशिष्टार्थमिदं सुयन्त्रं संसाधयामास नृलोकपालः ॥ ४१ ॥

- Fol. 53A, यो यौवनेपि विषयसृङ्गया विह्वीनो
भूत्वा प्रभुः शिवपुरीमविमुक्तसंज्ञाम् ।
गत्वा यथाविधि कृतत्रिपुरारिपूजा-
गङ्गावगाहनसुखः कृतकृत्य आस्ते ॥ ४२ ॥
- 53B, सेक्षसस्यधरणीं विदुषे यः
अदया कवलितो यदुभर्तुः ।
प्रीतये प्रणिददाति स राजा
साधकोत्र गदितः करुणाब्धिः ॥ ४३ ॥
- 54A, सुवर्णधेन्वादिकदानतः सतां
दारिद्र्यदावानलकालवारिदः ।
श्रीमन्मल्लैवम्भटपाल ईदृशो
यन्त्रेऽपि जातः किल साधकाग्रणीः ॥ ४४ ॥
- 54B, सङ्क्षशः सन्तु नृपाः पृथिव्यां
नामुष्य कुत्राप्युपमालवोपि ।
अक्षर्निशं पण्डितमण्डलीस्थो
यः श्रौपतेरेव करोति चर्चाम् ॥ ४५ ॥
- 55A, सदा महाभागवतं पुराणं
तथा महाभारतमुख्यमन्यत् ।
श्रीकृष्णलौलाचरितानुवादि
प्रियं मल्लैवम्भटपस्य नान्यत् ॥ ४६ ॥
- 55B, श्रीराजराजेश्वरवर्मराजपाठेन नित्यं क्षपितोपसर्गः ।
श्रीमन्मल्लैवम्भटपो निसर्गसिद्धातिदानावितसाधुवर्गः ॥ ४७ ॥
- 56A, पदे पदे सन्ति नृपाः प्रजानां
करग्रहादौर्मनैकदक्षाः ।
श्रीमन्मल्लैवम्भटपोपमातः
क्वावासमेषा लभतां पृथिव्याम् ॥ ४८ ॥
- 56B, अलब्धकामो नृपतेः परस्मात्
सन्त्यज्य सन्त्यज्य परं तमर्थी ।
सर्वोऽपि लब्धार्थ इहास्ति तूर्णं
श्रीमन्मल्लैवम्भटपाश्रयेण ॥ ४९ ॥
- 57A, सर्वप्रजाक्षेत्रसुरक्षणेदुरः कथं मल्लैवम्भटपालकाग्रणीः ।
भवेन्न चेत् पूर्वभवे विधानतः स्तृपासको यन्त्रपतेरमुष्य तु ॥ ५० ॥
- 57B, असुना पृथिवीश्वरेण किं प्रथमे जन्मनि साधु साधितम् ।
न हि यन्त्रमिदं न चेत् कुतो गतदस्युन्नजभौतिकाः प्रजाः ॥ ५१ ॥

- Fol. 58A, यथा पयशपूरादिकूटदुर्गजयोद्धुरः ।
श्रीमल्लैवम्भूपाल एतदुयन्त्रस्य साधकः ॥ ५२ ॥
- 58B, संसारदुर्गजय ईश्वरभक्तियोगाद्
भक्तिः सदा श्रवणतो वचसां श्रुतीनाम् ।
सत्पण्डितादिदमहो शुभपण्डितौघो
द्रव्यसृष्टाविरहितो धनवन्त्वतोऽस्य ॥ ५३ ॥
- 59A, श्रीमल्लैवम्भूपालवैरिणां वीर्यस्य संस्तम्भनकारकं त्विदम् ।
यन्त्रं कुतः शक्यविबोधमूढतामुपैति वीर्येतिपदस्य बुद्धिमत् ॥ ५४ ॥
- 59B, भ्रातृभ्यो यः पितृदत्तादशेषाद्
ग्रामान् स्वीयादप्यसौ वीरतृप्तः ।
सोऽयं राजा श्रीमल्लैवम्भूनामा
नान्यलौणिपालकर्तव्यकर्मा ॥ ५५ ॥
- 60A, अमुना राज्ञा नूनं साधितमेतत् पुरा यन्त्रम् ।
निर्विघ्नं कृतकृत्या प्रजा यदस्यास्ति सर्वापि ॥ ५६ ॥
- 60B, यः समस्तपुरुषार्थसाधकः शत्रुसङ्गुणद्विबाधकः ।
स्वीयराज्यचरचौरसायकः केवलं हरिगुणाभिगायकः ॥ ५७ ॥
- 61A, प्रतिदिवसमवश्यं दौपदानं विधाय
क्षितिपतिपतिवर्माभीतिसंस्तप्तेताः ।
निजगणगणतोत्राशेषभूपालरत्नं
जयति जयति भूमौ श्रीमल्लैवम्भूशक्तः ॥ ५८ ॥
- 61B, संसारसर्पभयतः कथमेष युक्तो
न स्यादहो नरपतिर्यदि साधितो न ।
यन्त्रेश्वरोयमथवा करुणामृताब्धे-
र्लक्ष्मीपतेः परिचितः परिपक्षिराजः ॥ ५९ ॥
- 62A, शालेति शल्येति पदार्थवाचकं
स्ववैरिणां शल्यमिवातिदुःसहः ।
यदग्निभूतोऽग्निषु तेन च ध्रुवं
स शत्रुशालोऽग्निमितः प्रभोः सुतः ॥ [६०] ॥
- 63B, प्रथमजनुषि जातः श्रीघनश्यामदेवो
मयि विहृतिनिराशः साम्प्रतं नैतदेव ।
उचितमिति तु मत्त्वा पार्वती वीरभद्र-
क्षितिपतितनयासौच्छ्रीघनश्यामराज्ञी ॥ ६१ ॥
- 64A, घनश्याममल्लामृपात् पार्वतीतः कुमाराच्च माराद् वरः कोऽप्यपूर्वः ।
दृष्टालो मल्लैवर्मः स जातो यतः स्वर्गदेवाद् वरा भूमिदेवाः ॥ ६२ ॥

- Fol. 64B, अरिमर्दननामासौ राजकुमारो द्वितीयो यः ।
सुकुमारकुमारतुला मारतुला चात्र जैनत्वम् ॥ ६३ ॥
- 65A, खाक्षीनामकशैले राजा दलसाहिनामाभूत् ।
यस्मिन् सौशसति पृथ्वीं नरका रिक्तलमायताः ॥ ६४ ॥
- 65B, दलसाहिराजपत्नी भवति [सुभ]द्रा सदा भद्रा ।
अतिवीरकर्मतोऽसुं मत्त्वार्जुनमिह सती पुनर्जाता ॥ ६५ ॥
- 66A, नरवरदलसाहिश्रीक्षितीन्द्रात् सुभद्रा
जनयति जनमध्ये चारुसंगेयकीर्तिः ।
इह महलवसन्तामिन्दिरा या नरेशं
भजति च कुसपत्नी श्रीमल्लैवम्भूपम् ॥ [६६] ॥
- 66B, अरौषां तु मल्लाः क्षणा[द्]ध्वस्तगर्वा
मल्लैवम्भूमिपतेस्तेन शङ्के ।
पुरा जन्मनीदं महायन्त्रमुच्चैः
समाराधितं स्यादिति स्वीयबुद्ध्या ॥ ६७ ॥
- 67A, श्रीमन्मल्लैवम्भूपाल उक्तं
यन्त्रं लिदं साधितवान् पुरैव ।
यदुर्वैरिभूमौश्वरसत्प्रतापी-
ऽनल्पानल[ः] स्तम्भिततामवापितः ॥ ६८ ॥
- 67B, श्रीमन्[म]ल्लैवम्भूपालः साधकोऽमुष्य वर्तते ।
कुलदृष्टिस्त्वितरथा कथं स्यादिति दुर्लभा ॥ ६९ ॥
- 68A, नाकपालसदृशारातिपाते न्विप्रवेगमपि वैरिणामेषः ।
कुष्ठितां गतिमहो विदधाति क्षापतिर्वरदयन्त्ररूपाभिः ॥ ७० ॥
- 68B, नूनमेष नृपतिः पुरा भवे यन्त्रराजसमुपासकाग्रणीः ।
नो यदीत्यभ[व]दे(मे)व जित्यशो जायतां कथमहो महाजयौ ॥ ७१ ॥
- 69A, राज्ञी महलवसन्ता सशस्त्रपृथ्वीप्रदानादौः ।
सक्तोषितभूमिसुरा भूमिसपत्नीप्र[ा]यास्ति भूपस्य ॥ ७२ ॥
- 69B, असुना नरपालस्तरिणा न ज संसाधितमसि यन्त्रकम् ।
यदमौ मनवोऽखिला अपि प्रतिवर्षन्ति समस्तसम्पदः ॥ ७३ ॥
- 70B, श्रीराजराजेश्वरदौपदान-
प्रतापविद्रावितचौरसंघः ।
अनीतिराज्योपि सनीतिराज्यो
नूनं पुरा जन्मनि साधकोऽस्य ॥ ७४ ॥

- Fol. 71A, श्रीमन्मलैवम्मादपाल आसो ह्यसुखं यन्त्रस्य तु साधकोऽत्र ।
न चेदमौ वैरिण उद्गराः स्युः कुतोऽतिवैकल्यपदं प्रयाताः ॥ ७५ ॥
- 71B, धर्मार्थकाममोक्षा यदुद्गारे भृत्यभावमापन्नाः ।
जयति मलैवम्माश्चो राजा कल्पद्रुमावेशः ॥ ७६ ॥
- 72B, साधकोऽत्र नरपालनायको गायकः प्रतिपदं रमापतेः ।
कर्मणामखिलकामदायकः मण्यको रिपुकुलक्षये भुवम् ॥ ७७ ॥
- 73B, घनश्यामस्तुनूर्न मारः कुमारो
न वा पार्वतीजो महादामशूरः ।
न कल्पद्रुमादिः पतिश्च[ऽ]पि लक्ष्म्या
न वा माधवोऽयं ह्यपूर्वीऽस्ति राजा ॥ ७८ ॥
- 74A, इह मङ्गलवसन्ताश्रीमलैवम्मादेवा-
वमरनिकरवश्यं यन्त्रमेतद् भजेते ।
न यदि सकलकामा देववश्याः कथं स्युः
करतलगतवासा एतयोरप्रय[त्ना]त् ॥ ७९ ॥
- 74B, कामधेनुसुरपादपावभावेकशोऽपि जगदार्तिनाशको ।
दम्पती तु सुतरामितौव किं तद्युगावतरणं युगं त्वदः ॥ ८० ॥
- 75A, सर्वयन्त्रफलसेवितपादः श्रीरमारमणसुस्मरणोत्कः ।
सर्वभूसुरसमौचितमोदः कोऽपि भूपतिपतिर्जयतीह ॥ ८१ ॥
- 75B, हसति हसितवक्त्रा रोषकाले च सृष्टा
शयनजुषि तु सुप्ता स्वीयपत्यौ निसर्गात् ।
इतिधृतशतरूपकान्त एषोऽतिशान्तो
मनुरपर इहास्ते श्रीमलैवम्मानामा ॥ ८२ ॥
- 76A, राज्ञी मङ्गलवसन्ता राज्ञी रूपानुसारेण ।
अवतीर्णा शतरूपा प्रियव्रतादिशुभपुत्रकाधाना ॥ ८३ ॥
- 76B, यन्त्रस्योपासको य[ः] क्षितिपतिर्तिलकः श्रीमलैवम्माभूषः
काश्यां गेहं सुसौधं प्रतिशरदशनादार्थकं चापि रायम् ।
महादर्शस्य कर्त्रे खगुरकरण्या प्रेमनिध्याकृत्याथ
अहामिदं ददाति प्रणिभवतुतमामेव पूर्णाखिलार्थः ॥ ८४ ॥

Philosophy of Rural Reconstruction in China.¹

By JOHN B. GRANT.

THREE MAJOR DESIGNATIONS OF ADDRESS.

Reconstruction in its broader aspect arises from the impact of Science upon Society and the necessity for social reorganization from paleotechnique empiricism to neotechnique experimentalism followed by orderly social control. The narrower aspect is in the sense of overtaking the lag between the twentieth century science and its immediate utilization for human welfare in unindustrialized agricultural society. This latter is the topic under discussion.

Rural reconstruction in China may best be made comprehensible by summarizing the major differences between it and reconstruction in India. Chinese organization is the result of three factors that must be explained to understand the differences. First is the 20 years of field experience and lessons learned. Second is the extension into the communities of the research and training interests of certain leading Chinese universities to develop the methodology of successful reconstruction and to train in these methods the senior staff requisite for administration. Third, the policy of reconstruction, particularly of the universities in question, is based upon defined principles whose acceptance must constitute the point of departure in planning for reconstruction if it is to be either significant or successful. This address discusses reconstruction under the three major designations referred to of experience gained, university participation, and the underlying principles now accepted.

HISTORY.

Rural reconstruction in China developed in the years between the end of the Great War and 1937. This period had two chapters—the first of empirical hit-and-miss methodology lasting till 1934 and the second, a period of systematic planned reconstruction based upon enunciated principles. The earlier period had a number of separate efforts very similar and corresponding to those observable regionally in India today. It is unnecessary to report the majority of these on account of their non-reproductiveness and consequent insignificance in determining

¹ An address delivered before the Royal Asiatic Society of Bengal—March 7, 1941.

the main course of evolution. The main movement centres around a single individual J. Y. C. Yen.

Mr. Yen proceeded immediately upon graduation in the Yale University to the Chinese Labour Corps in France during the war as a Y.M.C.A. secretary. His imagination was aroused by the almost complete illiteracy of the several lakhs of his countrymen recruited chiefly from Shantung province and this resulted in his initial efforts in adult education through evolving a basic vocabulary. This war interest led upon his return to China to the establishment in 1921 of the National Association of the Mass Education Movement; and, the circumstances were such that the movement became nation-wide within a short space of three or four years, particularly in urban areas. During this period the movement enlisted the co-operation of scholars to determine the most efficient basic vocabulary of 1,000 Chinese words that could be learnt by the young-adult in a series of lessons covering three months. The beginnings also were made of the requisite literature to implement the basic vocabulary. And, during this period several provinces were stimulated to establish departments of mass education. The predominantly rural character of China directed Mr. Yen's attention towards the agricultural population. Professors of agriculture, mostly trained abroad, were enlisted to prepare the requisite follow-up literature. However, it was found that the material was so far removed from the realities of the problems of the farmer as to be almost useless in interesting him. This led the Association to establish a rural branch in Tingsien about 100 miles south of Peking, where a few agriculturists settled down to determine through experience what were the real agricultural problems of North China. Mr. Yen was soon forced to the conclusion that no single social field of application of knowledge could progress very far in so backward a community without the concurrent establishment of other fields. He consequently turned for help to the respective university experts in and around Peking, which still was the capital as well as the educational centre of the country. It was this realization of the necessity for a co-ordinated solution of the problem and the manner whereby Mr. Yen was able to enlist the interest and enthusiasm of academic experts which laid the foundation for the planned reconstruction that evolved during the next decade.

It was during this decade after 1925 that 'reconstruction' methodology was experimentally developed in Tingsien in education, agriculture, public health, etc., based on the economic practicability and social conditions of North China. Both the National and the Provincial Governments gave official status to the Association's work in Tingsien, originally established for mass education, whereby the Association was given control of the Local Government through its ability to nominate the Magistrate of the subdivision having approximately four lakhs of

population. In the meantime, Mr. Yen solicited funds for support of the work from private channels in China and returned from a trip to the United States with contributions of (£100,000) five lakhs of dollars to support the veritable social laboratory, utilizing more than 100 technical workers which had gradually been established. The success of Mr. Yen prematurely attracted hundreds of officials and others from all parts of China to an extent that the railway authorities had to make special provision for the number of visitors who also seriously hampered routine activities. This prematurity of interest was dangerous through the discredit resulting from efforts made by many upon their return to their own localities to reduplicate what they had observed in Tingsien without having grasped the technical implications and, more important, lacking the trained technical personnel to undertake reconstruction.

The singlemost important result from Tingsien probably was the manner in which certain universities in and around Peking were stimulated to extend the responsibility and scope of their social disciplines beyond their academic walls into the community. This resulted in the appreciation that the social sciences, as much as the natural sciences, are not taught to but must be learnt by the students through opportunity for self-participation in community exemplifications of the principles presented in the classroom. Consequently, undergraduate students were sent to Tingsien under their instructors. Thus, in medicine the fourth year students had three weeks' rural, added to their previous urban, 'clerkship' in public health, during which time opportunity was afforded for some participative experience in addition to general orientation in rural reconstruction as a whole through demonstrations provided in each field. This development of university interest coincided with the growing national demand for reconstruction that experience proved could be successful only if based upon effective methodology and personnel trained in such methodology. The natural outcome of this university interest was the establishment of a formal organization in 1936 designated the North China Council for Rural Reconstruction, consisting of five universities, the Mass Education Movement, and the Shantung Provincial Government. The purpose of the Council was stated to be 'a correlated community programme of rural reconstruction through which controlled field facilities and services for applied training and research in the social sciences may be made available to its constituent institutions and to provide personnel of high quality to the various enterprises for social reconstruction in China which now are in so great need of trained workers'. The Council functioned through a Rural Institute which carried on instruction and research in the applied social sciences of civil administration, economics, social medicine, education, agriculture, and engineering. The Council was given political control by

Government of the first administrative area of Shantung province possessing approximately ten million population. The Institute as the joint representative of the Council, universities, and the Government possessed the authority to operate the constituted community facilities through power to nominate its personnel to the official Government posts of the area. The universities' departments as such lost their individual identity in the field and functioned solely through the Institute as their co-ordinating agency. Faculty members resided in the field. Within this area the Council through its Institute designated one subdivision of five lakhs of population as its intensive experimental-demonstration field. The Institute consisted of two divisions—the community service division responsible for the routine administration of the area, composed of the heads of instructional departments together with the chiefs of the sections or bureau of Government, whereby teachers from the universities were concurrently appointed as Government officers. The educational-research division was composed of the heads of departments of instruction, and it was this second division which dealt with all matters relating to the educational and scientific policy of the Institute and whereby its representatives on the community service division was able to control and modify governmental administration in terms of its educational and scientific needs. Planning was done in the first instance by the Institute for subsequent approval by the Council and finally by the Provincial Government. The annual budget of the Institute, apart from routine civil administration expenses, was approximately four lakhs of Chinese dollars.

The Council and its Institute were interlinked by means of either its Council or Institute representatives serving on various boards and committees of National Government and advising the latter's policy on the one hand, while Government in turn was represented on the Council and was able to guide Institute policy in terms of the realities of governmental administration. A Rural Reconstruction Committee of the National Economic Council of the Government was established at Nanking to co-ordinate the different fields of government and corresponding to these represented in the Council's Institute.

The colleges of the participating universities drew up syllabi for their departments to take advantage of such a controlled community and requiring the residence in the field for several months of the undergraduate during the last year of instruction. Students were given a brief horizontal introduction to the several co-ordinated fields of social function before 'clerking' vertically in their specific subject. Special facilities were also designed to permit of a limited number of graduate students in each of the social fields. However, any international consideration of China requires the bearing in mind of certain facts relating to the time when a modern Government was established.

Although the Revolution took place in 1911, it was 1927 before the Nanking Government inaugurated civil administration in the modern sense. The chief cause for the non-implementation of the 1911 Revolution was the absence of technical personnel. The first Government university was established as late as 1905, the first permanent Government medical college in 1912 and other technical colleges even later. Consequently for successful rural reconstruction next to solving the problem of proven methodology, it was considered necessary to establish provincial institutes of public administration to provide personnel of a vocational level. It was to train the teachers for the latter that the University Council Institute set as its instructional task because it was obvious that reconstruction would continue in name only until provided with modern social servants competent to initiate and to supervise the utilization of modern knowledge in the daily lives of the people. Also by 1937, reconstruction in China had reached a stage where an acute problem had arisen to protect the movement from being discredited through unsuccessful results of hurriedly created provincial bureaux lacking the essentials here described, particularly methodology and personnel. At this point it becomes necessary, in order to interpret the Council in its true perspective to comprehend both the background of sociological thought common to the constituent members of the Council, as well as the general social-economic level of rural China. The following representation of the philosophy must be understood as one's own recollection of the numerous references which were in circulation between the various senior members of the Council and the innumerable hours of evening discussions that occurred in the quiet rural atmosphere of originally Tingsien, and later Tsining, the seat of the Institute in Shantung.

PHILOSOPHY AND ECONOMIC LEVEL.

Historians and scientists agree that society is in a major transitional epoch corresponding in its revolutionary character to the two major ones previously experienced by mankind, viz. the period of the preliterate culture to the dawn of history when society was founded and the ancient civilizations were established. This second period continued until the present transformation of society began 300 years ago with the European renaissance. Social reconstruction to be intelligent or rational implies planning. Planning is obviously inadequate unless designed in relation to the eventual social scheme as a whole. The trend of the present transitional period of social organization can be defined only in terms of the past and knowledge of differences in the present resulting from new factors which have arisen. Social thinkers previous to the present century expressed ideas on society which increasingly are now becoming accepted

fact. Thus Rousseau¹ defines the Social Contract of Society as : 'That form of association which will defend and protect with the whole common force the person and goods of each associate ; and in which each, while uniting himself with all, may still obey himself alone and remain as free as before'. John Stuart Mill² in 'On Liberty' clearly foresaw what is today the world's crisis when he defined the biological basis which social law must evolve towards in respect to individual freedom of liberty : 'Whenever in short there is a definite damage or a definite risk of damage either to an individual or to the public the case is taken out of the province of liberty and placed in that of morality or law'. Herbert Spencer³ in his 'The Data of Ethics' defined the conflict between collective and individual cultures long before the present crisis arose, proving the truth of his diagnosis : 'But here we are met by a fact which forbids us thus to put in the foreground the welfare of citizens, individually considered, and requires us to put in the foreground the welfare of the society as a whole. The life of the social organism must, as an end, rank above the lives of its units. These two ends are not harmonious at the onset ; and, though the tendency is toward harmonization of them, they are still partially conflicting. As fast as the social state establishes itself, the preservation of the society becomes a means of preserving its units. Living together arose because, on the average, it proved more advantageous to each than living apart ; and this implies that maintenance of combination is maintenance of the conditions to more satisfactory living than the combined persons would otherwise have. Hence, social self-preservation becomes a proximate aim taking precedence of the ultimate aim, individual self-preservation. This subordination of personal to social welfare is, however, contingent ; it depends on the presence of antagonistic societies. So long as the existence of a community is endangered by the actions of communities around, it must remain true that the interests of individuals must be sacrificed to the interests of the community, as far as is needful for the community's salvation. But if this is manifest, it is, by implication, manifest, that when social antagonisms cease, this need for sacrifice of private claims to public claims ceases also ; or rather, there cease to be any public claims at variance with private claims. All along, furtherance of the individual lives has been the ultimate end ; if this ultimate end has been postponed to the proximate end of preserving the community's life, it has been so only because this proximate end was instrumental to the ultimate end. When the aggregate is no longer in danger, the final object of pursuit, the welfare of the units, no longer needing to be postponed, becomes the immediate object of pursuit'.

¹ Jean Jacques Rousseau, 'The Social Contract and Discourses', p. 14.

² John Stuart Mill, 'On Liberty', p. 48, 1913.

³ Herbert Spencer, 'The Data of Ethics', pp. 133-134, 1879.

Today, it is universally acknowledged that the determining force which shapes society is Economics. The essential factor determining Economics is 'Energy'. Machine energy is synonymous with the Industrial Revolution has been clearly analyzed by Stuart Chase in 'Technocracy: An Interpretation'. Chase advances the conception of energy magnitudes being the condition governing political and social institutions. The present emerging third stage was preceded by two earlier stages. Primitive communities had worked primarily by virtue only of the food eaten by their members converted into physical power of human muscle. The chief engine was the human being and his available energy determined the standard of living of the community and its social institutions. This power of the human engine is measurable by its food intake and is equivalent to 2,000 kilogram calories *per capita* per day and this was the sole energy during the first period of man. The second period originated with the early civilizations when the domestication of animals and crude water power was added to man's energy, thereby doubling the magnitude to 4,000 kilogram calories *per capita* per day. This second period extended for approximately 7,000 years until the invention of the steam engine in 1775. Since that time the machine age, developed with the utilization of coal, electricity, and oil, has stepped up capacity in such a country as the United States to 160,000 kilogram calories *per capita* per day.

It is the lag of eighteenth century economic and political institutions behind this twentieth century power that has become the basic world problem. Reconstruction to overtake this lag in the application of scientific knowledge to human welfare is confronted by two problems: the material one of the lag itself and the larger social one of instituting the necessary collectivism while safeguarding the maximum degree of individual freedom commensurate with the welfare of the group as a whole.

Social reconstruction to be successful requires technical knowledge and the most efficient form of organization for the application of that knowledge. It is axiomatic that the form of administration is determined by political organization and that in turn derives from the *per capita* energy production of the country and the economic philosophy. The organization in democracies has been determined by capitalism. Capitalism as a system was first defined after the beginning of the Industrial Revolution and then passed through the three periods of Industrial, Monopoly, and Finance Capitalism, corresponding roughly to stages in the progress of science particularly with reference to its development of power and transportation, because these two are the new major factors.

Industrial capitalism resulted in the form of social administration designated as democracy but has never attained to the substance. The latter is defined as 'the form of government which asserts the worth and validity of the individual

man and that the aim of society is to secure to him the maximum of responsible freedom'. This definition means that society itself must consciously and responsibly aim at social justice which will ensure the closest possible approximation to equality of opportunity for each member to lead the 'good life'. Consideration of rural reconstruction in the restricted sense of this paper implies the enumeration of the unsocial biological results that have arisen in older industrialized countries and which planning should aim to avoid in countries now becoming industrialized. Such an enumeration includes the problems of population, human migration, race, health, urbanization, rural economic crises, cultural lag, social pathology, including diversification of social classes and groups, and poverty. No successful scheme of rural reconstruction can be formulated without knowledge of, and conscious consideration to obviate, these problems that inevitably follow in the wake of uncontrolled industrialization, economic development, and unplanned democratization. It is not, however, within the scope of this paper to go beyond the hope that officials submitting plans of reconstruction designed to overtake social-economic lag in rural communities possess the knowledge of, and have given the necessary consideration to, the foregoing pre-requisites of historical perspective. Major economic factors arising from scientific progress and their resultant problems when uncontrolled must constitute the background of any thinking, if reconstruction is to claim planned technical competency and is to prove successful.

In addition, the administrator must have the equally necessary knowledge of and consideration for the social fields in which application has to be made. Society in the course of evolution has gradually differentiated, or is in process of differentiating, certain major functions listed below:—

1. Education.
2. Protection of Life, Property, and Natural Resources.
3. Production of Goods and Services. Distribution of the Returns of Production.
4. Consumption of Goods and Services.
5. Communication and Transportation.
6. Recreational Use of Leisure.
7. Expression of Religious Impulses.
8. Expression of Aesthetic Impulses.
9. Integration of the Individual (Service to Society).
10. Extension of Freedom (Political Education).
11. Extension of Knowledge and Adaptation to Invention.

The first seven have been clearly differentiated while the last four are sufficiently recognizable to be thus classified. Certain of these major functions in turn have become so well established that they now have developed subdivisions which are themselves autonomous social administrations, as, for

instance, Public Health under Protection, and Industry or Agriculture under Production, etc. Consequently, individuals responsible for planning reconstruction in the sense of overtaking the lag in utilization of knowledge should presumably possess technical information of the extent the organization and administration of each has developed in progressive countries, particularly with respect to their latest trends in order that their experience is available to obviate introduction of wrong methods of organization and administration in the backward community under consideration. Furthermore, the complexity and vastness of modern social-economic organization implies that the social architects in charge of reconstruction must possess comparable knowledge of *principles* requisite for successful organization and administration of each technical field for which establishment is being undertaken; and, without which the structure planned for is as much doomed to collapse as would be the building of a skyscraper or ocean liner by architects proceeding merely along the lines of neolithic rural-cum-empirical knowledge. An example may be taken from the field of public health.

Public health is organized community effort to provide individuals of the community with the greatest degree of utilization of medical knowledge for the three objectives of maintenance of health, the prevention of diseases, and the cure of disease. The organization to attain these objectives effectively together constitute public health administration. Experience has postulated that efficient administration is proportionate to adherence of the following six principles:—

- (i) The necessity for the administration of the different health functions being undertaken for the whole community by a single governing body and not for different sections of the community by several governing agencies, with necessary co-ordination between inter-related sections; in other words, there should be 'centralized direction and decentralized activity'. The administration must provide for technical supervision and periodic appraisal of the efficiency of the organization.
- (ii) Successful administrative procedure results only from scientific investigation and demonstration of organizational methodology in the measures whereby knowledge can be applied in practice to groups of population. The proper training of the necessary personnel in applying the methodology is an important requirement.
- (iii) Successful administrative procedure must be based upon sound financial considerations and practicable economic budgetting suited to the area and the population. Where cash purchase of health reform

is difficult, the available cash may be utilized for technical guidance and supervision and the citizens may offer trained voluntary labour (= payment in kind), which is the largest item in cash purchase of medical protection.

- (iv) Successful community utilization of knowledge for public health reform and medical protection requires a certain level of politico-economic progress and education. Health of the people is eventually achieved through the people being themselves possessed of adequate education in, and practice of, health knowledge.
- (v) The securing of co-ordination between the related spheres of social services, owing to their mutual interdependence.
- (vi) In order to ensure better working and to avoid mistakes in local effort, *the whole design* of a public health planning must be before the mind from the beginning. Any effort, however small and localized, can confer benefit, if it is designed in relation to the scheme as a whole.

These principles may aptly be termed the normal functions of that organ of society designated public health, and dis-functioning of any one or more must produce social pathology resulting in the symptomology of increased morbidity and excess mortality. The second is the one most observably violated in Bengal, where, for instance, the specific mortality for the past decade from such an entirely controllable a disease as smallpox has been 43 per 100,000 as compared with 0.07 and 0.02 for the Philippines and Java, which formerly had the same high rate as Bengal. Consequently, it behoves that reconstruction relating to medical protection to be successful must be planned in terms of these principles rather than be undertaken empirically and so be doomed to inadequate and disappointing results. Similar competency to plan in terms of principles for *each* social field must be the qualification of any director of reconstruction, who is in this respect comparable to the chief of a general staff who would not presume for an instant to undertake, himself, the planning or the operation in any single field but solely discharges the function of co-ordinating into a whole scheme the technical principles and resultant details from the several differentiated technical fields. ●

It has been stated, apart from the immediate problem of overtaking the social lag in as backward a community as China, i.e. catching up on the present, that immediate planning had to be undertaken in terms of larger world trends, i.e. in terms of the future, to obviate the necessity later on for reconstructing the organization then being established. The principles govern-

ing and determining the whole eventual social design were not new. For instance, one of the major social results of technological developments since the middle of the nineteenth century was the bringing into prominence of classes who formerly were largely voiceless. 'Democratization of society' ran parallel with the ever-growing interdependence of individual activities upon one another to constitute a large whole of efficient social function. Technological advances transformed individualistic into a herd society, in which individual competition was replaced by group co-operation. The resultant subordination of the individual was compensated by the improved economic and cultural levels necessarily obtainable only through group action and therefore planning. The impact of science and industrialization upon *laissez-faire* agricultural civilizations increasingly created individual insecurities, thereby resulting in herd impulses towards salvation by organized security. This produced expediency palliatives through various forms of social welfare and new deals inaugurated especially during the past half a century. One of the results is the transition from recording history in terms of the past to the development of a sociology attempting to shape history out of the emergent forces of the social process now going on and so avoiding the necessity for future palliatives. This recent trend is important as marking the first period when man is collectively setting up goals and organizing himself and society towards scientific attainment of these goals through planning and planned thinking.

Planning requires grasping the complex of events from a number of key positions, from each of which the whole design has to be kept in mind in undertaking individual steps. It is only through this approach that concrete social events previously thought to be accidental can be seen to be the result of principles working throughout the society and that their occurrence can be predicted. Mannheim designates these forces as 'the principia media'; and the importance of understanding these forces for social reconstruction arises from the fact that society cannot be rationalized as a factory, because its complex and various living characteristics if not understood will upset the plan. Consequently, planning is the application of foresight to human affairs, so that social progress increasingly proceeds towards a unity regulated through differentiated knowledge of the major social functions. The problem involved is twofold, because in addition to reorganization of society, there must be the freeing and full development of individual man through a new education. The chain of events constitutes a cycle beginning with Galileo and Copernicus and extending through Arkwright and Watts to the changing ideas about man from Rousseau and Herbert Spencer to the contemporary encyclopaedists. The lag of social techniques must overtake mechanical inventions and technological

improvements. This demands the achievement of a dynamic equilibrium that must solve the problem of security of the group as a whole. This can be accomplished only through adequate social techniques co-ordinated towards a general defined objective. Such planning would produce a rational mastery of the irrational forces of uncontrolled industrialization. The fundamental basis must be education whereby human beings become influenced towards desiring the greatest good of the society as a whole. Numerous educational experiments are being made, especially in the past two decades, directed towards this aim. In turn, social techniques require a new type of personnel for administration which is resulting in the civil servant developing into the social servant. In brief, science and increasing industrialization imposes the necessity for functional rationalization of social organization towards objective ends. A planned economy implies definite social goals to avoid being a contradiction in terms. This requires a planned social strategy to co-ordinate all fields of human endeavour through organizing social action towards the optimum good of the greatest number. The foregoing has been re-postulated and summarized by Mannheim in 'Man and Society' from which much of the summary viewpoints has been borrowed. This review of the sociological thought of the constituent members of the Council may seem unduly lengthy. It, however, must be fully comprehended to understand the underlying philosophy and aims of the Council and of the goal of rural reconstruction. The description in 1910 of a model T Ford in itself might have proved an interesting new phenomenon in transportation but without comprehension of the underlying principle of the internal combustion engine the description could not foretell either the 1940 Mercury or the Spitfire, which a knowledge of the principles of the crude 1910 engine would permit envisaging.

'LAND UTILIZATION IN CHINA', edited by J. Lossing Buck (1937), is a basic study of agricultural and population problems from which further social-economic details are obtained but a summary picture of rural China is as follows. The land under cultivation is twenty-seven per cent. Agricultural development is difficult in consequence of fragmentary holdings. Land-owners consist of forty-four per cent of the agricultural population; twenty-three per cent are part-owners; and thirty-three per cent tenants. The medium size of farm area is 3.3 acres. Taxation varies widely from locality to locality but may be said to be 5.2 Chinese dollars per acre. Illiteracy exists amongst sixty-nine per cent of males and ninety-nine per cent of females. The death rate per 1,000 of population is 27 and the birth rate 38.3. Thirty-nine per cent of farmers are in debt. The *per capita* income for rural areas is 80 Chinese dollars per annum, including the value of all the product supplied by the farm.

SUSPENDED ACTIVITIES.

While the China Incident of 1937 disrupted the Council's work almost at its inception in terms of materialization of the eventual plan conceived along the broad principles enumerated above, it may be of interest to report the immediate specific programme in mind when war was declared. The Council had accepted the three necessary factors in social planning, viz. population, natural resources, and the technical arts, with the objective of correlation of these three factors in terms of the principles referred to. These in turn resulted in the postulation of the three initial problems that must be successfully solved in social application, namely, competent personnel, successful methodology, and the problem of organization including finance. The first two were considered the production aspect of rural social planning while the third was the marketing of what has been produced for the benefit of the community. Thus, the universities constituted the factories of methods and personnel and the Institute field the testing laboratory for marketing. The Council considered that the determining one of the three above factors of social planning was that of power, and that consequently an area whose size and boundaries had been decided entirely by a pre-machine age conditions would not permit the solution of the eventual problem in mind. This problem is internationally similar in nature and has probably been best defined with respect to the Tennessee Valley Authority and described below. When the China Incident arose, the Council was actually in process of proceeding along the following lines to implement its responsibilities of social planning along neo-technical lines.

The Council through the National Economic Council was considering a survey of the natural self-contained power units of the country similar in scope to that undertaken by Roosevelt for the United States and whose report has predicted the eventual redistribution of political boundaries of that country's 48 States in terms of seven natural power provinces. It was expected that the completion of such a survey in China would then permit the North China Council to remove its Institute to one of the eventual units for its development on a planned social-economic basis. There seemed every likelihood that there would be no difficulty in securing the large capital which would have been required to develop the power of that area and that must constitute the starting point of a really planned and largely self-contained community. The war naturally suspended development along these lines.

Any conclusion of possible international value from the efforts towards rural reconstruction in China described above would seem to be the extension of university interests to community problems and recognition of responsibility for its colleges

in the social fields to undertake research in determining methods for the efficient utilization of knowledge for the betterment of human welfare and training in these methods. In this connection it is of interest to note the trend of thought in the United States in connection with the experience of the Tennessee Valley Authority already referred to. This experiment is probably the single greatest effort outside of the totalitarian States to develop co-ordination between control of national resources and their more efficient utilization for human welfare through the social organization of society; embracing as it does an area covering part or all of seven States with a population of ten million. The present Director of the Authority, Dr. Morgan, has postulated (1938) that, 'Unless the appropriate fields of universities can be brought into a more realistic relationship with the problems of our democracy, there will be no basis for assurance as to the future. For if this is not done, there is little reason to believe that the basic conflict of ideals in our capitalistic democracy can be resolved sufficiently to preserve public confidence in democratic institutions as a way of life'.

Dr. Morgan's reason for his conclusions was derived from the experience of the Authority which resolved the multiplicity of local reconstruction problems under four heads:

1. Land.
2. Economic.
3. Social.
4. Political or Governmental.

Thus, under 'Land' are included conservation and utilization of natural resources, the problems of flood control, soil poverty, farm tenancy as well as the conflict between agriculture as a way of living and agriculture as a commercial or industrial undertaking, in addition to the problem of agricultural surpluses. 'Economic' includes the effects of local, national, and international markets on problems of plant food supply, the imbalance of population with the centralization of industry, etc. The 'Social' problem includes housing, collective bargaining, technology and unemployment, farm tenancy, etc. The 'Political' problems raise the questions as to whether governmental units should be based upon political or economic considerations; how to make legislation responsive to public needs; the whole subject of taxation, etc. Analysis of any single major problem revealed its inter-relationship to others of equal magnitude. Analysis of the etiology and the previous effort at solution of these problems indicated their hitherto unrelated channels and consequent failure of solution, thereby perpetuating the fallacious public notion that our evils are unrelated to their causes. The inter-association of the various phases and relationships of these problems are summarized in the analysis in the appendix.

The approach to solve these problems revealed three great needs that had to be met and which revealed that the single greatest problem should be Education, viz. the university, because these three needs proved to be personnel trained in reconstruction, a better informed public understanding of what a successful programme involved, and technical and scientific research capable of being related and translated into solutions of regional and national problems. This extended social responsibility, scope of universities implied not only research into the problems listed, but a *translation programme* whereby a system of education should be developed in order that courses of study should include exercises, laboratory and field demonstrations, in the social-economic problems of today, adequate to accommodate instruction from Kindergarten to Graduate and Adult Education. The problems in the more economically backward China led to the same general conclusions.

It may be of interest to conclude by summarizing some of the interesting war developments of the Council groups following the necessary flight of its Institute from Shantung to Kweichow and later to Szechuen.

WAR DEVELOPMENTS.

There is not time to give the credit due to the indomitable spirit of the faculties and students of the numerous institutions which had to flee into Free China, often after overland marches of over a thousand miles on foot. The chief effect on the Council was that the geographical separation of universities from the Institute precluded the latter from continuing its university functions. The Institute staff remained largely intact and it was reconstituted in 1938 in the Tingfan subdivision of Kweichow province as a vocational training institute to serve provincial reconstruction needs. In the meantime, the Mass Education Association had removed its headquarters from Hopei to Hunan province, where it was given the responsibility by the National Government of organizing a provincial public-administration training institute of a vocational nature for a complete war reorganization of the administration of the province, which was expected to be the front-line after the fall of Hankow. Developments forced the evacuation of the movement to Szechuen province. Here, in early 1940 the movement under Mr. Yen in collaboration with the Council Institute established a National College for Rural Reconstruction. This is in effect an institute for training of three categories of personnel in public administration, which was made possible by the removal of the Institute's resources from Kweichow to Szechuen. The newly constituted college was provided with Tachu, the tenth prefectural area of the province, as its community field and immediately inaugurated post-entry training of two types: an A type for senior adminis-

trators consisting of mature men, many of whom had received their training abroad and had held administrative posts in China. The second, B type, was for young graduates to constitute junior personnel. In addition, it is expected that opportunity would afford in 1941 for reaffiliation with universities who had located themselves in the province, in order to renew undergraduate training. The reconstituted institute, in its training-research programme, retains the six departments which were established in Shantung. Its non-routine-administration budget, however, has had to be reduced to approximately Rs.2½ lakhs per annum.

One of the most significant war reconstruction developments of the Government has been Industrial Co-operation. China's modern industry had become established only near the treaty ports and this was the area occupied by the Japanese within the first 12 months of the China Incident. Free China could only remain free provided in addition to war supplies she could assure a minimum of essential consumer goods. Circumstances of transport and of particularly finance would have made import almost prohibitive. Fortunately the imagination and foresight of a half a dozen private individuals were able to bring together the two essentials required for the establishment of industrial co-operation, namely, tools and trained workers. A significant quantity of the former were evacuated to the interior from the coast by Herculean effort. There were hundreds of mechanics of various categories among the thousands of refugees and these were registered and assigned to specific functions. Initially the movement got under way through private funds collected by the small handful of enthusiasts whose demonstration was sufficient to 'prime the pump' in obtaining Government support. In less than three years, some 1,700 societies with 23,000 members have become established with a monthly production of eight million Chinese dollars. The dependants of these members number 200,000. The products come under ten main categories and are meeting an important part of the nation's military and industrial needs. It is expected that the eventual establishment of 30,000 of these co-operatives will provide an economic base which would make China relatively independent of most of the essential items hitherto imported.

Many of these industrial co-operatives have formed also supply and marketing departments. The movement has been fortunate to enlist foreign expert advice on technical matters and some degree of research. These emergency societies will undoubtedly lead to a future national federation after the war. Groups of them have already formed Unions, the various departments of which are linking up with Farmers' Societies for the purchase of raw materials, and it is hoped that this will result in the permanent establishment of numerous Consumers' Societies, and bring about the completion of the co-operative circle, with

the pre-war credit and marketing societies. Another ancillary activity, although possibly as significant as the establishment of industrial co-operation itself is its development of education. The Chinese co-operative law decrees that five per cent of the profits must be utilized for a common good fund. The industrial co-operatives are providing ten per cent for schemes of education and welfare. This education is remarkable in that it emphasizes manual skill and science as well as literary and social activities in the group. There has been an additional problem to solve in meeting the necessity, particularly under the war-time conditions, to train staff for the rapidly expanding industrial co-operation movement and which has been initiated under almost insuperable difficulties in seven regional institutes, where organized courses for 10-12 weeks are given as preliminary to 'post-entry' training in the co-operatives themselves.

DIFFERENCES BETWEEN CHINA AND INDIA.

Rural reconstruction to overcome the lag between Medievalism and the utilization of modern knowledge cannot be successful if dependent entirely upon cash purchase. The latter on account of low economic conditions and inadequate purchasing power must be limited largely to providing the training of self-help workers and their supervision together with necessary additional technical functions which cannot be provided through voluntary effort. The recognition of this principle came early in the Chinese experience as it has here also in India. But in China there are two fundamental differences—that supervision through cash purchase is functional and specific rather than general and non-specific as in India and that training of voluntary workers is chiefly through drills while lectures are limited entirely to demonstration as the reconstruction worker can be trained successfully only by action and never through talk. The former difference requires amplification. The specific problem of reconstruction is postulated as follows: Knowledge of better seeds, of improved animal husbandry, of successful methods of co-operation, of control of causes of excess mortality due to gastro-intestinal disease, malaria, smallpox, etc., is available, but the problem is development of methods which will bring the knowledge within the practice of the individual villager. It would seem that the trend in India, referring to Bengal particularly, is to select trainees from groups of villagers in each *thana* who will each be provided with a smattering of knowledge in all fields during the period of a few weeks in camp and upon return to their respective villages will be responsible for initiating new practices in these fields into the daily lives of the villagers. Supervision of these peripheral and voluntary workers comes through the Circle Officer, who possibly may contact each trainee once a month or at longer intervals. This

Circle Officer himself is a general administrator, who has not had technical training in any specific field. Consequently, while possessing an intelligent realization of the problems involved he must refer technical matters for solution to the duly constituted authority somewhere between him and the Divisional Centre with all the delays attendant in India upon instituting a new file and securing action. However, the most serious defect is the absence of proved methodology in which the trainee can be drilled. This methodology for the purpose in view must be one that under technical supervision has been shown to be practicable of undertaking by voluntary 'self-help' effort. It is insufficient, for instance, to tell the trainee that gastro-intestinal disease is due to soil-pollution and contaminated water to be controlled by sanitary night-soil disposal and safe water. He must, himself, be given repetitive opportunity to dig latrines and wells. And these and other drill measures must have been previously standardized for local conditions.

The Chinese methodology was developed along functional lines as being more effective under rural circumstances. Experience proved that a voluntary village worker with the limitations of his own education and the technical background providable in a brief period could not effectively undertake self-help development in more than one field; and, he could even then do this only if provided with constant technical supervision. The result of experience led to the following unit scheme of organization based upon an area and population that in India would be a subdivision. Administering this is encountered the first 'general' administrator, under whom were functional divisions designed to bring the necessary technical supervision to the voluntary village worker at frequent intervals. In turn, the village workers were designated by each one or two villages (approximately 200-300 families) for training in each major field provided at the subdivisional centre and as stated the training was entirely drill. Supervision and technical services were organized in terms of the particular administrative needs of each field. For instance, the maximum number that could be handled by the unit of the primary health centre was found to be 20,000 population in a radius of 3-5 miles, whereas the primary peripheral units of agriculture and of co-operation were 4-5 times this area and population. There is no time to describe the detailed administration of even one field. But the following summary of the public health may illustrate the principle in question. Self-help in the village was represented by three individuals: the voluntary health worker, the school teacher, and the 'dai'. Each received a period of drill at the secondary subdivisional centre in previously defined standardized routines. The technical staff at each primary health centre consisted of what in India would be designated a Sub-Assistant Surgeon, a Visitor, and a Dresser-compounder. These had received drill

training at a district base. The primary centre personnel discharged their curative functions in the mornings to the patients largely referred from the village health workers and in the afternoons rotated through the 15 or 20 villages to undertake supervisory technical functions chiefly preventive. The primary centre staff returned to the subdivisional secondary centre over the week-ends for 'post-entry' training. In the meantime the 'D.P.H.' type of personnel at the secondary subdivisional centre spent part of the week supervising the primary centres. Similarly, the village workers, as circumstances demanded, attended the primary centres for conferences, and once a year returned to the secondary centre generally during New Year's. The cost of such a health administration was approximately 15 Chinese cents per annum or between 2-3 annas *per capita*, taking the purchasing power of the rupee as equivalent to the Chinese dollar.

The mechanism of rural reconstruction as eventually stabilized was to take the subdivision (hsien) as the unit of operation and to set-up the secondary centre at the subdivisional headquarters. This included technical personnel and facilities for each of the social fields. Mass education was the vehicle through which other reconstruction activities were built around. Experience proved that little value could result from education of adults after the age of 30 years and consequently mass education was limited to adolescents and young-adults. The products of education were constituted into a self-governing village association who selected individual members to be sent to the secondary centres for training in the separate fields and then upon completion of training were made responsible for the extension of activities in that field within the village. As has already been indicated, in each field the voluntary workers were provided with standardized plans which were supervised from the primary technical centre of each administration. It was considered that the initial stage of reconstruction was passed when the village in question had reached the level of constituting its own primary school, the teachers for which, regardless of previous conventional training, were given additional instruction at the Normal School at the secondary centre. Stabilization of reconstruction required the period necessary until the products of these schools could take their place in the community. The pedagogic motive within the school was one whereby the pupils reduplicated various activities of community life in their school syllabus particularly in agriculture, co-operation, health, and civics.

The characteristics consequently of Chinese reconstruction are:—

- (a) Specifically trained voluntary self-help in the villages for each major social function to be reconstructed.

- (b) Weekly supervision of voluntary workers in each field by specialized technical officers.
- (c) Administration organized by specialized function from the secondary subdivisonal centre through to primary centres in the villages. The first generalized officer met with was the one administering a subdivision.
- (d) The development of administrative methodology is the responsibility of universities who themselves control large units of population for the purpose of determining practical means of applying basic knowledge for the welfare of the individuals in the community. The university is naturally also responsible for training the senior administrative officers in each major field of application of knowledge. The junior personnel are trained locally at the district base while the village workers receive their training at the subdivisonal secondary centre.

The equipment and methodology of activities from the subdivisonal base to the village were standardized.

The primary function of reconstruction in China was to initiate and to co-ordinate interested and duly constituted organizations and institutions to the joint solution of social-economic problems of the villages. Reconstruction administration did not include the responsibility either of solving the technical problems, which were considered to be a responsibility of institutions, or of administering activities that was the responsibility of duly constituted technical administrations. This policy seems significantly different on both counts from that developing in India, where reconstruction *qua* reconstruction not only itself attempts to develop the methodology to solve the social-economic problems but is even undertaking administration duplicating duly constituted administration. This policy is wholly untenable and will have to be revised if reconstruction in India is to produce significant results.

This foregoing difference in the two policies of organization and administration in China and India may be summarized as flexible technical judgment versus rule of thumb orthodoxy. There can never be a doubt as to which is the more resultful when it is a question of fixed programme of files and procedures against deeper technical discipline based upon strategy and planning.

REVIEWS OF BOOKS.

STUDIES IN THE PURANIC RECORDS ON HINDU RITES AND CUSTOMS. By R. C. HAZRA, M.A., Ph.D., Lecturer in Sanskrit, University of Dacca. Published by the University of Dacca, Bulletin No. XX, 1940, pp. 367.

This work was approved as a thesis for the Ph.D. degree by the University of Dacca in 1936. In it the author has made a careful study of those chapters of the purāṇas that deal with Hindu rites and customs. His aim is to describe the vicissitudes of Hindu socio-religious life during different historical periods in the past. Dr. Hazra's book is divided into three sections. In the first, the chronology of the relevant puranic chapters has been considered ; in the second, the different stages of development of Hindu religious rites have been discussed and the third section consists of an appendix giving a list of references to puranic texts quoted by the authors of the smṛti books. The preparation of this list must have involved a tremendous amount of labour on the part of the author. These passages form the source material of Dr. Hazra's book. This section will prove to be extremely useful to future scholars working on this or on some allied problem. Dr. Hazra has tried to determine the chronology of the puranic chapters that deal with social order and religious practice by correlating their contents to the various works on smṛti. For the dates of the smṛti works he has generally relied on the findings of Mr. P. V. Kane as described in the latter's *History of Dharmasastra*, Vol. I.

Dr. Hazra deserves the highest praise for the diligent care he has taken in collating the original puranic texts with the quotations found in the smṛtis but it is to be regretted that he has not been able to do full justice to his own material. One naturally expects that a scholar who deals with topics discussed by the purāṇas should have a fairly accurate conception of the nature of these books. This is a question of fundamental importance. Dr. Hazra's notion of the purāṇas is open to serious criticism. He has failed to recognize the distinction between the purāṇa and the mahāpurāṇa although the topics discussed respectively by these two classes of books have been definitely stated in more than one place by the authors of the purāṇas themselves and are known to Dr. Hazra. These passages will enable any one to see that the purāṇas in their pure form do not exist as separate books at present. They have been merged in the mahāpurāṇas. It is, however, quite easy for anybody interested in the subject to separate the pure puranic portion, by the five well-known characteristics of sarga, pratisarga, vaṁśa,

manvantara and varṁśānucarita, from the other materials, viz., descriptions of religious rites, etc., forming the rest of the topics of the mahāpurāṇa. It seems further that the author has no clear notion of the five topics of the purāṇa and the relations they bear to one another. One should know exactly why these five topics are grouped together in the purāṇas before one can confidently assert that he has understood the full value of the puranic material.

The author has uncritically followed the European scholars in translating 'pratisarga' as 're-creation' and 'manvantara' as 'cosmic cycle'. As a matter of fact 'pratisarga' as a topic of the purāṇas means 'dissolution of the creation' and not 're-creation' or 'secondary creation'. The dissolution of the universe has been described in Vāyu, Chapter 102, under the heading 'pratyāhāra'. 'Pratyāhāra' is the same as 'pratisarga' as will be seen from the use of the latter term in the same chapter in slokas, 46, 53, 131, 132, 133 and 135. If the author had taken pains to read the topics considered under 'manvantara' he would have immediately seen that this term is a technical one indicating time scales. The ancient purāṇakāras have described in connection with manvantara the time scales they employed for various purposes and their methods of indicating chronology. In fact it is clearly stated in Vāyu, I. 79, that manvantara deals with the knowledge or information about time. The term manvantara has also been used to denote the period of one manu. There are fourteen manu periods in each 'kalpa' cycle which has been conceived on two scales, viz., 'human' and 'divine'. It is the 'divine' kalpa only that may be called a cosmic cycle.

The author is under the impression that the sources of the five different topics discussed in the purāṇas are to be traced to tales, anecdotes, songs, lores, etc. (see p. 4). In support of this view he has quoted a śloka from the purāṇas. This śloka with slight variants is to be found in Viṣṇu, Vāyu, etc. The Viṣṇu śloka is as follows:—

ākhyānaiḥ cāpyupākhyānair gāthābhiḥ kalpaśudhibhiḥ
purāṇasaṁhitāṁ cakre purāṇārthaviśāradāḥ.

—Viṣ., III. 6, 16.

The author has taken this śloka to mean that tales, anecdotes, etc., 'were used by Vyasa in compiling the original purāṇa' (pp. 4, 5). The correct meaning of the śloka is that Vyasa compiled a purāṇasaṁhitā (a puranic collection and not an original purāṇa) and added to it the material derived from tales, lores, etc., or in other words he converted the purāṇas into a mahāpurāṇa. The third case inflexion in the words 'ākhyānaiḥ', etc., in the śloka does not signify 'by means of' but 'together with' ākhyāna, etc. (see Śrīdharabhāṣya on the śloka). Having failed to distinguish between the true nature of the puranic and that of the non-puranic materials in the mahāpurāṇa it was easy

for the author to assert that 'the present purāṇas have practically turned into smṛti codes' (p. 5). According to the purāṇakāras the puranic material proper was collected not from tales and traditions but from personal observations of reliable persons known as sūtas (Vāyu, I. 31-32, 4. 8, 99. 213; Matsya, 164. 16-18; Brahmāṇḍa, 1. 21). That the purāṇas contain records of past events is to be seen also from Vāyu, I. 201, and Matsya, 53. 71 ślokas.

Besides the five puranic topics the mahāpurāṇas deal with visarga or secondary creation, means of livelihood, the incarnation of God for the purpose of maintaining religious and social order, the manifestations of prakṛti and the supreme Brahma. The descriptions of various religious rites and customs prevalent at different times thus form the legitimate subject-matter of the mahāpurāṇas. The mahāpurāṇas have been classified under three heads according as they give prominence to Brahmā, Viṣṇu or Śiva, not for any sectarian purpose but as specialized records of beliefs and customs with reference to the three aspects of the Godhead. It is certainly true that devotees of particular sects have utilized different mahāpurāṇas for the furtherance of their own faith.

The author is under the impression that the determination of the date of composition of a puranic chapter will enable him to fix the chronology of the socio-religious events discussed in the chapter. The mahāpurāṇas, according to their own statement, have been repeatedly redacted at different periods, and ancient materials have found place in comparatively recent writings. For instance, in the third book, eighth chapter of Viṣṇupurāṇa, Maitreya asks Parāśara a certain socio-religious question. Parāśara replies that in ancient times King Sagara asked this very question of Ourva and that he will repeat Ourva's teachings to Sagara in answer to Maitreya's question. The presumption is that in this chapter an ancient tradition has been preserved, and it will be very hazardous to assert that the date of composition of this chapter denotes the time when the customs described therein were prevalent. Our author has taken no pains to avoid this fallacy. It is unjustifiable to assume, as the author has done, that the descriptions of the Kali age refer especially to the disorganization of the society in the post-Buddhistic period. As a matter of fact the original Kali and the Kalki traditions refer to a much earlier period. The puranic Kali age started at the time of Yudhiṣṭhira and according to the Kalkipurāṇa the exploits of Kalki were events of the past. It says Kalki married the daughter of king Bṛhadratha, took king Viśākhayūpa as his ally and killed king Suddhodana and all mlecchas, yavanas and other heretics and restored dharma on this earth. (Kalki, 1. 4. 30; 2. 1. 25; 2. 3. 76; 2. 7. 28.) The names of these kings are to be found in the puranic dynastic lists and they had flourished long before Buddha.

The author believes that the purāṇa texts were written as a whole at some time or other and therefore whatever was added later should be considered as interpolation. Had the author appreciated the true nature of the purāṇas he would have seen that it was the aim of the purāṇakāras as honest recorders of events to keep the purāṇas up to date by the addition of fresh material. In some cases the names of the successive redactors have been mentioned in the purāṇas themselves. Unfortunately the sources that fed the purāṇas dried up some time after the Andhras and the later efforts to keep the purāṇas living were of a sporadic nature. The mention of such comparatively recent events as the reign of Queen Victoria in the Bhaviṣya Purāṇa by some unknown redactor is thus quite in keeping with the spirit of the purāṇas. Therefore, the question of chronology of any particular chapter of any purāṇa is to be considered an useful problem only so long as it helps us to find the chronology of the events and customs described therein.

Wherever Dr. Hazra has found a similarity of language in the description of events or a similarity of events themselves in two different purāṇas he has jumped to the conclusion that the one must have borrowed from the other. Dr. Hazra forgets the possibility of a common source, such as a prevalent tradition or the descriptions given by the sūtas from whom the purāṇakāras, according to their own statements, got their materials. Dr. Hazra writes: 'Many myths and legends, which are found in a concise and older form in the Viṣṇu-p. appear in the Bhāgavata in a much enlarged and elaborate version.... In the Bhāgavata there are stories which are not found in the Viṣṇu..... From all this it appears that the Viṣṇu-p. is older than the Bhāgavata' (p. 22). It is needless to point out the logical fallacy that underlies such deductions from negative premises but unfortunately this is a favourite style of argument of the author.

Wherever in any purāṇa Dr. Hazra has been unable to trace a connection between a previous description and an immediately succeeding one he has supposed that interpolations have occurred. I quote a typical example. 'Again, in Mat. 50, 68-71 (Vā. 99, 260-263; the Vāyu differs in readings in several places) the sages, wishing to hear of the future, put to Sūta several questions about (1) future kings—their names and the periods of their reigns, and (2) the future ages—their characteristic signs, their merits and defects, and the happiness and miseries of the people during these ages. Consequently Sūta, promising to narrate to them the future Kali age, the future Manvantaras and the future kingships, begins with the future kings and answers all the questions in Mat. 50 (verses 77 to the end = Vā. 99, 270-280a) and 271-273 (= Vā. 99, 281, to the end). About the future Manvantaras, which Sūta himself wants to narrate nothing is said in the Matsya-p. whereas in the Vāyu these are dealt

with in the following chapter (i.e. chapter 100). From these disagreements between the two purāṇas it follows that the Matsya-p. borrowed only those chapters from the Vāyu which it found necessary without caring for the lines containing references to other chapters of the Vāyu' (pp. 29-30). In the first place it is not correct to say that Matsya-purāṇa has not dealt with future manvantaras. In Chapter 51 which follows the one containing the sūtas' promise we do find a description of the future manvantaras as promised by the sūta. Then again in Chapter 9 also of the Matsya-purāṇa future manvantaras have been described. Dr. Hazra would have us believe that the interpolators must have been very foolish people as they even failed to efface the lines containing tell-tale references.

In another place the author writes: 'thus the unknown interpolator creates an opportunity for himself to insert some of the chapters of the Kūrma-p. In doing so he has tried to efface the Śaiva stamp which these chapters bear. Thus in a few places the names of Śiva have been replaced conveniently by those of Viṣṇu, while in many other places the names of the god have been retained intact' (p. 111).

It seems that according to our learned author it was not only the interpolators that showed a curious admixture of foolishness and carelessness but also the smṛti authors showed similar traits. He writes: 'The few cases, in which the verses quoted by Hemādri from the Bhaviṣya-p., are found in the Uttara Parvan, must be due to the confusion between the titles "Bhaviṣya" and "Bhaviṣyottara"' (p. 170). According to the author although some of the smṛti writers knew the apocryphal character of the present Brahma-purāṇa still they quoted from it. They were foolish enough to believe in the authoritativeness of the upapurāṇas and to give them the same importance as the mahāpurāṇas as sources of dharma (pp. 146, 151). The attitude, seen in some modern scholars, of considering purāṇakāras and other ancient authors as foolish and careless persons incapable of even simple calculations, indulging in all sorts of exaggerations for the purpose of deceiving people and unable to guard themselves against inconsistencies which even a child would detect, is indeed curious.

In Part II of his book the author, in trying to give a description of the Hindu society and the different stages in the development of puranic rites and customs, has depended generally on non-puranic sources; he has merely reflected the well-known views of the European scholars. The author's wrong ideas of the nature of the purāṇas and his unfamiliarity with the broad principles of the Hindu religion and of the relations existing among the vedas, the smṛtis and the purāṇas, have landed him in a pitfall in many places. European scholars have been familiar with the history of an almost continuous enmity between the Church and the State in their own country and they have

naturally assumed from the record of a few quarrels between a Brāhmaṇa priest and Kṣatriya ruler that in India also there must have been a similar eternal opposition between the Brāhmaṇas and the Kṣatriyas; their personal attitude towards the caste system and towards the supremacy enjoyed by the Brāhmaṇas in certain affairs of life made them readily believe in the anti-thesis, brahminical and non-brahminical, which they have ridden to death. It is a pity that some Indian scholars should allow themselves to be dominated by such views.

The absence of critical insight on the part of the author has resulted in his making contradictory statements at several places. He writes on p. 252, 'From what has been said above it is clear that in the Purāṇas the Brāhmins adopt every possible means to make the people bounteous to themselves. They are not, however, satisfied with this even. They become so greedy for gifts that they call upon the administrative power of the king to force the people to be charitable to themselves in normal times as well as in famines . . . The avaricious character of the gift-seeking Brāhmins seems also to be indicated by the stories of fatal quarrels over the possessions of gifts'. In p. 255, however, the author draws quite a different picture. 'In spite of all their preachings for gifts, the Brāhmins seem never to have ignored the ideal of simplicity and asceticism. They formulate that a Brāhman should live a simple life in which excess of wealth should have no place. He should not be greedy, nor should he be anxious for the acceptance of gifts, because greed of money causes degradation. He should accept from others only the amount which will give him a bare subsistence . . . they are to spend it for the maintenance of their dependents, for the worship of gods, for entertaining guests, for performing sacrifices and for making gifts, but never for enjoyment.'

Inferences, deductions and interpretations are not the author's strong points but the book will be considered valuable for its appendix.

G. BOSE.

THE SANTAL INSURRECTION OF 1855-57.—BY KALIKINKAR DATTA, M.A., Ph.D. Published by the University of Calcutta, 1940.

Dr. Datta deserves our thanks for drawing attention to the little known Santal Insurrection. Historians are divided between those who can see a pattern in the sequence of events, and those to whom the pattern remains hidden. This story at least points a moral, that even the humblest subjects of a country are affected by changes in the government. Unlike the Sepoy mutiny, the Santal rising was not in its origin anti-British, nevertheless it was a result of the spread of British power in India. The extension of the reign of law and order gave more security to the propertied classes, and so far as the Santals were concerned, legalised the rapacity of the money lenders into whose clutches they were falling. The administration was inexperienced in the art of protecting special classes of people, and a widespread breakdown of authority resulted. All this has been well brought out by Dr. Datta, who also devotes most of his pages to an account of the outbreak and progress of the insurrection, and the measures taken to suppress it. He has assiduously searched record rooms in Bhagalpur and Dumka, and has also unearthed some contemporary manuscripts in Bengali and Hindi, which portray vividly the hysteria which prevailed in the bazaars of what is now the Santal Parganas in the rainy season of 1855. It is hard to escape a feeling, however, that the actual events of the insurrection, and government measures for suppressing it were of little significance in themselves. The occasional clashes between troops and the hordes of primitively armed rioters (for that is what they were in fact), hardly deserve to be treated seriously as military operations.

We confess to being disappointed with Chapter IV, entitled 'Sequel to the Insurrection'. Not only was the Government convinced of 'the necessity of adopting prompt measures to bring Santali areas under an effective administrative control', but the creation of a non-regulation district led to the possibility of Government regarding itself as the trustee of the Santal, and so setting up a system of administration suited to primitive people. How far this opportunity has been successfully used is another matter and one which we could scarcely expect to find debated in a history of the insurrection. There is not sufficient recognition of the fact that there are very considerable Santal areas outside the area in which the disturbances took place, in which the Santals continued to live for many decades under difficulties which were removed for their brethren in the Santal Parganas as a result of the insurrection. It is not entirely accurate to picture the direction of missionary activity to the aborigines as one of the important results of the insurrection.

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1. All communications submitted to the Society for publication should be addressed to the General Secretary and not to any officer by name. They should be type-written on one side of the paper with sufficient margin on the sides, and *in all respects must be absolutely in their final form for printing.*

2. Papers must be accompanied by a brief abstract not exceeding 1,000 words, which shall indicate the subject of the paper and the nature of the advance in the existing knowledge on the subject.

3. Tables of contents (for long papers), references to the plates and literatures, etc., should be given in their proper places.

4. Quotations in Oriental languages should be in the original script, and wherever they are transliterated the System of Transliteration adopted by the Society must be followed (see instruction 15). The names of *genera* and *species* in the case of biological communications should be underlined to indicate that they are to be printed in italics.

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5. All drawings and photographic prints should be as clear as possible. They should be in a form immediately suitable for reproduction, preferably of a size to permit reduction to about two-thirds the linear dimensions of the original, and should be capable of reproduction by photographic processes.

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SANSKRIT

अ = a आ = ā इ = i ई = ī उ = u ऊ = ū
 ऋ = ṛ ॠ = ṝ ऌ = ḷ ए = e (or ē) ऐ = ai (or ai)
 ओ = o (or ō) औ = au (or au) (Prakrit अद् अउ = aī, aū)
 ऽ (Anusvāra) = m : (Visarga) = ḥ × (Jihvāmūliya) = χ
 ॡ (Upadhmāñña) = φ

Sandhi Vowels may be indicated as â î û ê ô. Avagraha = '.
 Accents in Vedic—Udātta á ā etc. Svarita—â.

क ख ग घ ङ = k kh g gh ṅ (or ṇ)
 च छ ज झ ञ = c ch j jh ñ (or ṇ)
 ट ठ ड ढ ण = ṭ ṭh ḍ ḍh ṇ
 त थ द ध न = t th d dh n
 प फ ब भ म = p ph b bh m
 य र ल व = y r l v (or w)
 श ष स ह = ś ṣ s h
 ङ ञ = ḷ ḷh

HINDI (and other North Indian Speeches)

As for Sanskrit, only nasalised Vowels are to be indicated by a *tilde* mark (˜) above the Vowel (e.g. अँ अॉ अँ अँ = ā ã ū aī,

etc.), and ढ ढ are to be denoted optionally by either d dh or by ṛ ṛh. Care should be taken in distinguishing ब and व (b and v)—the latter preferably may be written as w rather than v, specially in intervocal and final positions. The final silent -a may be optionally omitted : but in quoting Early Hindi, etc. the final a should be retained. ठ ठह as in Rajasthani, Panjabi, etc. are to be indicated as in Vedic.

BENGALI

The system for Sanskrit, with the provision for nasal Vowels and for ড ঢ (= ढ ढ) as in Hindi. For য (অন্তঃস্থ য), in all *tatsama* or pure Sanskrit words, *y* should be employed, in Prakritic and semi-*tatsama* words, *j*; subscribed য (= য-ফলা) should be indicated by *y*. The difference between বর্ণীয় ব (= b) and অন্তঃস্থ ব (= v, w) need not be indicated for Bengali—b may be written for both : only subscribed ব (য-ফলা) is to be written as *w* (e.g. Skt. *Viśvāsa* = Bengali *Biśwās*). Final -a may be omitted optionally, but it should be retained for Early Bengali.

ARABIC

In transcribing Arabic, according to the context either (i) the native Arab pronunciation (as current in the *Jazīratu-l-‘Arab*) or (ii) the Perso-Indian pronunciation may be followed.

(i) Arabic in native Arab Pronunciation—

أ (alīf hamza) = ’; ب = b, ت = t, ث = th (or θ) ; ج = j (or ǧ), ح = h, خ = kh (or χ, or x) ; د = d, ذ = dh (or δ) ; ر = r, ز = z ; س = s, ش = sh (or š) ; ص = s, ض = d ; ط = t (or t), ظ = z (or z) ; ع = ’, غ = gh (or γ) ; ف = f, ق = q ; ك = k ; ل = l ; م = m ; ن = n ; و = w, ū ; ه = h ; ي = y, ī.

اَ اِ اُ respectively = a, i, u (or ə, ø optionally in place of i, u), آ = a, i, u ; اَ اِ = ā ; اِ اِ = ī ; و = ū ; اِ = ay (or ai) ; و = aw (or au) ; *tanwīn* = ^{un, an, in} above line ; ع = ā. (Note : عبد الحق = ‘Abdu-l-Ḥaqq, or ‘Abd al-Ḥaqq, not ‘Abd-ul-Ḥaqq.)

ه = t (or h, or th).

(ii) Arabic in Perso-Indian Pronunciation, in the case of the following letters—

ث = ś, ذ = ź, ص ض = š ž, ط ظ = ṭ ṣ.

PERSIAN

As for Arabic in Perso-Indian Pronunciation, with the following special Persian letters added :

پ = p, چ = ch (or c, or ĉ), ژ = zh (or ž), گ = g.

و may be indicated for Persian by v rather than w.

For Early Modern Persian, and Indian pronunciation of Persian, the *majhūl* sounds of و and و (= ē, ō) may be employed side by side with the *ma'rūf* sounds (= i, ū).

و و = au, ai. Nasalisation (*nūn-i-ghunna*) may be indicated by *tilde* mark (~) on the top of the Vowel, as in the case of Hindi, etc.

Hā-i-mukhtafi can be represented optionally as ah or a.

The *Izāfat* is to be written as -i- (or -ē- optionally).

URDU

As for Persian, only و = w, rather than v. See also the directions for Hindi. The special Urdu letters in the Perso-Arabic alphabet for Urdu are to be transcribed as in Hindi, e.g. ث = ṭ, ڈ = ḍ, ژ = ṛ (or ṛ).

TAMIL

In transcribing Old Tamil, the modern pronunciation should not be followed—an exact transliteration will be enough for the purpose. This is in case of the consonants, which for Old Tamil should be indicated as below :—

க = k (never g, even medially) ;	ந = ñ (or ṇ)
ச = c (never ś, or j) ;	ஞ = ṇ̃ (or ṇ̣)
ட = ṭ (never ḍ, even medially) ;	ண = ṇ ;
த = t (never d, or th) ;	ந் = n ;
ப = p (never b, or v) ;	ம் = m ;
ய ர ல வ = y, r, l, v ;	ஈ = ī ; ன = n' ; ற = r' (ன்ற = n'r',
not ndr ; ற் = r'r', not tt) ;	ழ = ṣ (or ḷ) ; ூ (<i>āytam</i>) = h.

Long ē and Long ō are to be distinguished from the corresponding short vowels by the *macron* or length mark—the short e and short o being left unmarked.

TIBETAN

Vowels—	a	i	u	e	o
Consonants—	k	kh	g	ṅ	(or ŋ)
	c	ch	j	ñ	(or ɲ)
	t	th	d	n	
	p	ph	b	m	
	ts	tsh	dz	w	
	ž	z	'	(or ɣ)	
	y	r	l	š	s h

Silent letters need not be attempted to be indicated in transcription, but if necessary, the modern pronunciation may be denoted by some consistent system of phonetic transcription within brackets after the transliterated Tibetan (or *vice versa*).

CHINESE

Usually the North Mandarin Pronunciation should be represented, in Wade's system, with tones denoted by numerals. As far as necessary or practicable, the original Chinese character and the reconstructed pronunciation of it in Ancient Chinese should be given within brackets.
